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Maritime Domain Awareness FY08 Assessment Report

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13. ABSTRACT (Maximum 200 words.)
The U.S. Navy has been given the responsibility to develop a comprehensive, worldwide Maritime Domain Awareness (MDA) capability. PEO C4I has specified and assessed an initial set of systems, designated Spiral-1, to support MDS. Deputy Under Secretary of the Navy (DUSN) has appointed the Naval Postgraduate School (NPS) to assess the overall capabilities and needs of MDA. This document reports the progress made in developing MDA capabilities during FY08. It summarizes information from PEO C4I system tests conducted by OPTEVFOR and from information gathered by NPS.

14. SUBJECT TERMS
Maritime Domain Awareness, MDA, FY08 Assessment Report, MHQ/MOC, MDA Spiral-1, NPS, Naval Postgraduate School, DUSN, Department Under Secretary of the navy, Program Executive Office, PEO, Command, Control, Computers, communications, and Intelligence, C4I, Test Risk Reduction Limited Objective Experiment, TRRLOE, Empire Challenge 08, EC08, FAIRGAME, EMIO, CONOPS, TTPs, SOPs

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1.0 Executive Summary

1.1 Objective

The U.S. Navy has the responsibility to develop a comprehensive, worldwide Maritime Domain Awareness (MDA) capability. The Deputy Under Secretary of the Navy (DUSN) has appointed the Naval Postgraduate School (NPS) to assess the overall capabilities and needs of MDA. The objective of this document is to report the progress made in FY08 to improve the effectiveness of the warfighter in MDA missions.

This report focuses primarily on the set of MDA systems that Program Executive Office (PEO), Command, Control, Computers, Communications, and Intelligence (C4I) has designated Spiral-1. The assessment is based on data from numerous FY08 tests, experiments, and studies of MDA systems directed by PEO C4I and conducted by Operational Test & Evaluation Force (OPTEVFOR) in FY08 or by NPS. Specifically, this report aggregates and analyzes observations, surveys, chat logs, and interviews from six experimental and practical exercises that use MDA Spiral-1 technologies, and from other events in which those technologies were discussed by operational personnel. To these data, we have applied a comprehensive assessment structure and method that have been developed and validated in the Trident Warrior exercises that began in 2002. The assessment structure is customized to MDA, and it can be used throughout the MDA program to evaluate technologies, organizations, processes and other enabling components of the MDA solution. Our findings and recommendations are presented using this structure. (The specifics of this structure are explained in Section 3, below.)

Note that raw data from the OPTEVFOR Quick Reaction Assessment (QRA) (FAIRGAME) event is not available, and is therefore not addressed in this report.

1.2 MDA Program

The MDA program spans many regions, technologies, and policies.

MDA was triggered by a Presidential Initiative (White House, 1998). This, in turn, stimulated a requirement for a QRA to be conducted for MDA Spiral-1 Acceleration leave behind capabilities.

A Secretary of the Navy (SECNAV) project was promulgated and is managed by PEO, C4I to increase the United States maritime security through MDA. This MDA project will develop an enhanced capability to identify threats in the Maritime Domain as early and as distant from our shores as possible. It will do so by integrating intelligence, surveillance, observation, and navigation systems into a common operating picture (COP) accessible throughout the U.S. Government.

The MDA Science and Technology (S&T) Prototype develops technological systems to support MDA. These systems, collectively, are designated MDA Spiral-1. The effort is in the formative stage. Thus, the prototype capabilities have broadly stated capability thresholds and objectives.

1.3 Analysis Method

The Maritime Domain Awareness (MDA) program has conducted a series of tests of Spiral-1 systems. PEO C4I has received report results from these individual tests. This report looks across these tests and other events conducted by the Naval Postgraduate School (NPS) to assess overall MDA capabilities. The venues from which we have drawn data for this assessment are:

- NPS Site Visits for workflow development & a Process Engineering Workshop (PEW)
- Test Risk Reduction Limited Objective Experiment (TRRLOE)
- Visit Board Search and Seizure (VBSS) School
- Trident Warrior 08
- Empire Challenge 08
- FAIRGAME

The data from these venues were largely qualitative – including survey comments, chat logs, data collector's observations, and interview notes. Some quantitative survey data were also available. These data were assigned to categories of the assessment framework, which consisted of a hierarchy of assessment areas concerning: System Performance, Operations Performance, Organization/Guidance, and System Supportability and Readiness. (None of these data directly addressed a fifth assessment area: Warfighter Performance). Each item in each category received a rating indicating that it described a strength, a concern, or a deficiency in an MDA system, suite of systems, or deployment concept for systems

1.4 Summary of Findings

Most of the data analyzed here described strengths or concerns of MDA systems. Few users identified deficiencies in these systems. The scores indicate that all of the assessed technologies increased the warfighter's effectiveness to some degree, yet there was little information about the level of enhancement of MDA capabilities provided by the suite of Spiral-1 systems due to the lack of data on baseline levels of performance.

Specifically, in the quantitative assessment, areas of greatest concern (lowest average scores) were:

- Operations Performance for EMIO*
- Several sub-areas of Organization/Guidance concerning MDA Compatibility (specifically, alignment of MDA activity with ONI)
- Guidance (especially the need for MDA CONOPS, TTPs, and SOPs)
- Agreements (concerning data sharing)
- System Management
- Security
- System Supportability
- Readiness

*Assessment for EMIO was obtained through an actual operational experiment, not a system test. This differs from the rest of the results which were obtained from structured laboratory events.

The most highly rated sub-areas were:

- Operations Performance concerning Knowledge Processes for vessel of interest (VOI) development and tracking
- Organization/Guidance concerning Maritime Headquarters with Maritime Operations Center (MHQ/MOC) Compatibility with MDA
- System Performance concerning the Operations Support provided by these systems.

Finer categorization, a synopsis, and a score for each item are presented in later sections of this report.

1.5 Summary of Recommendations

PEO C4I and OPNAV should press forward with development and fielding of several technologies that received high marks for operational utility: FASTC2AP, Global Trader, PANDA, Tripwire, and CMA.

OPNAV should evaluate the expressed concerns, deficits, and return on investments for several technologies that received low marks for operational utility or system concerns: MDA Data Sharing – Community of Interest (DS-COI), Electronic Maritime Interdiction Operation (E-MIO) Wireless, and MAGNET. OPNAV should also consider placing technologies in reach-back facilities (e.g., at ONI rather than at NAVCENT) if those technologies require robust technical support and operator competence, that is, technologies with have high utility but low accuracy, reliability, or usability. Recommendations concerning the fielding and support process are offered.

In addition to the recommendations above concerning System Supportability and Readiness, we offer recommendations regarding System Performance (re: usability, redundant functionality, baseline specification functions, data sources, data source education, common data, and training) and Organization/Guidance (concerning process interoperability, and information flow impedance). (See section 5.0, below, for detailed recommendations.)

1.6 Future Assessment Recommendations

We recommend that observations be conducted to establish a baseline on MDA capabilities using current systems, in order to better estimate the impact of Spiral-1 systems. We recommend that some experimentation and observation address other technologies that promise to improve MDA effectiveness. Such systems include CMMA, NEPTUNE, GALE-Lite, Palaemon, PANDA, and Sea Watch.

OPNAV and PEO C4I should develop exercises that train and test MDA capabilities (technologies, tactics, techniques, and procedures (TTPs), organizations,

etc.), with a particular focus on handling realistically large numbers of cooperative, intentionally uncooperative, and inattentive white vessels.

Finally, we advise OPNAV to ensure that future assessments capture data that support computational, "what if" modeling of the impact of new technologies, processes, manning, and organizational structures. Such measurements will enable the Navy reuse scant data productively and predictively, thus multiplying the return on each assessment dollar.

2.0 Background

2.1 Objective

This assessment report fulfills the following statement of work, issued to NPS by PEO C4I:

1. Refine a project plan that provides a concept of operations (CONOP) and TTP around the core operational threads (e.g., standard work flows, or "business practices") to be then further used for operational field experimentation in Trident Warrior 08 (planned for execution in June of 2008).
2. Specify measures and metrics related to decision making and the continued evolution of MDA system elements that contribute within the GWOT (Global War On Terror), and are also consistent with DoD, JCIDS experimentation, and acquisition program needs.
3. Integrate efforts across MDA working groups, brought together in operational testing venues, under a consistent experiment design process that will also include standard metrics developed for MDA analysis of capabilities to ultimately assess Spiral-1 capabilities against fleet requirements.

Accordingly, this report (1) defines the current MDA workflow that new systems must support and how these new technologies will impact the current MDA workflow (see sections 8.4 and 8.5), (2) defines a measurement and assessment framework for evaluating MDA systems (technological, procedural, and organizational), and (3) applies that framework in an assessment of MDA systems.

2.2 Motivation

Maritime Domain Awareness (MDA) is a National Security concept that relies on the aggregate capabilities of multiple government agencies such as the Department of Defense (DoD) and Department of Homeland Security (DHS), as well as other federal, state, and local agencies in order to achieve comprehensive situational awareness of any threat associated within the Maritime Domain.

The National Plan to Achieve Maritime Domain Awareness (October 2005) defined the Maritime Domain as "all areas and things on, under, relating to, adjacent to, or bordering on a sea, ocean, or other navigable waterway, including all maritime-related activities, infrastructure, people, cargo, and vessels and other conveyances." Furthermore, the National Plan identifies Nation-state, terrorist, transnational criminal and piracy, and environmental and social threats within the Maritime Domain. In order to address these threats, the National Plan requires the capabilities to:

- Persistently monitor in the global maritime domain vessels and craft, cargo, vessel crews and passengers, in all identified maritime situation awareness areas of interest

- Access and maintain data on vessels, facilities, and infrastructure
- Collect, fuse, analyze, and disseminate information to decision makers to facilitate effective understanding
- Access, develop and maintain data on MDA-related mission performance.

The Department of Defense, following guidance set forth from the National Concept of Operations for MDA, developed the Fleet Concept of Operations for Maritime Domain Awareness (13 March 2007) and the Navy MDA Concept (29 May 2007), which describe the Fleet role in MDA and how Fleet commanders will develop and maintain MDA to accomplish Navy missions across the full Range of Military Operations (ROMO).

Operations for MDA (August 2007) provide a foundation for developing interagency and agency-specific policies, processes, procedures, and organizational relationships to align activities that contribute to achieving MDA throughout the Global Maritime Community of Interest (GMCOI).

In a memorandum dated 17 May 2007, the Secretary of the Navy directed the fielding of a prototype MDA capability by August 2008, and established a Cross Functional Team (CFT) to oversee the effort. The memorandum directs the following end state:

1. Begin fielding an enduring operational MDA capability.
2. Spiral-1 will:
    a. Provide a capability to the U.S. Central Command (CENTCOM) and U.S. Pacific Command (PACOM) Areas of Responsibility (AORs), interagency partners, and select friendly and allied nations.
    b. Create a network that, at multiple levels of security and across multiple domains, will feed many data streams into a common operational picture (COP) accessible throughout the United States Government and foreign or Coalition partners.
    c. Be able to handle time sensitive maritime threats.
    d. Be designed for expansion.
3. The effort will be used to resolve or develop new policy and procedures for MDA.
4. Subsequent spirals will extend this capability and add functionality.

The Deputy Chief of Naval Operations (Communication Networks) (N6) and Acting
Deputy Under Secretary of the Navy (DUSN) were designated as co-chairs of the MDA CFT. The Assistant Secretary of the Navy (Research, Development, & Acquisition) (ASN (RDA)) designated the Space and Naval Warfare Center's (SPAWAR) Program Executive Office for Command, Control, Communications, Computers and Intelligence (PEO C4I) as the Acquisition Lead for delivery of the SECNAV's MDA Prototype.

Deputy Under Secretary of the Navy (DUSN) appointed the Naval Postgraduate School (NPS) to assess the overall capabilities and needs of MDA, per the scope of work specified above.

Within the NPS assessment team, our motivation is to assess and improve the effectiveness of warfighters on MDA missions.

2.3 MDA Spiral-1 Technologies

This assessment focuses on the eight Spiral-1 technologies, which were tested in FY08. These technologies are:

- Comprehensive Maritime Awareness (CMA) – The Naval Research Laboratory's enhanced vessel tracking project
- Law Enforcement Information Exchange (LInX) – The Naval Criminal Investigative Service's non-classified system for information sharing of law enforcement information
- Global Trader- The Office of Naval Intelligence's cargo data and anomaly detection too
- Maritime Global Network (MAGNet) – The Coast Guard's intelligence program backbone database with enhanced anomaly detection for people
- Tactical E-MIO System Wireless – An E-MIO data collection and transfer system
- FAST2CAP – A common maritime operating picture that allows the watchstander to construct, implement and reconfigure search agents
- Tripwire – ONI's threat detection tools
- Google Earth – A commercial toolset for fusing data and displaying it on a globe
- MDA Data Sharing Community of Interest (DS COI) – A system for disseminating AIS data

Data concerning other non-Spiral-1 MDA systems (e.g., PANDA) were also collected during the test events, and these results are also included in this report. .

2.4 Summary of Next Sections

In the following sections we describe our method of analysis (Section 3.0), summarize our findings (Section 4.0), present recommendations (Section 5.0), and present detailed findings in each assessment area (Section 6.0). In sections 4.0 and 6.0, we present the average scores in each category as assessments of the MDA technology, as we interpret these from the categorized, qualitative data. Finally, appendices present raw data and other material of interest.

3.0 Assessment Method

The assessment method used for this MDA effort extends the techniques developed and refined in the Trident Warrior series of exercises since 2002. The elements of this method, in brief, were:

1. Define a framework for assessment in the domain: MDA
2. Collect data from test and experimental venues
3. Categorize data using the framework, assign scores to categorized data, and summarize the data

We describe these steps in more detail below.

3.1 Assessment Framework

The MDA assessment framework specifies a three-level hierarchy of assessment areas, metrics to evaluate performance, and specific measures. This framework is designed to address technological systems, organizational structures and processes, policy or guidance and other factors that ensure a robust mission capability.

The assessment framework addresses five distinct assessment areas, and two levels of sub-areas within them. (For a complete structure description see section 14.0.) The five assessment areas are:

- *System Performance* concerns how well a system performs its functions, its support of MDA operations, warfighter acceptance, automation, and system management and security functions.
- *Operations Performance* addresses the quality of knowledge management concerning Vessels of Interest (VoIs), MDA intelligence, surveillance, and reconnaissance (ISR), and MIO.
- *Warfighter Performance* focuses on operator acceptance and understanding of the MDA mission, as well as unit and individual capability to execute that mission.
- *Organization/Guidance* focuses on the fit of organizational structures and processes to the MDA mission (including MHQ w/ MOC), the sufficiency of agreements between entities, and the adequacy of guidance within entities.
- *Supportability and Readiness* concerns factors that ensure MDA Spiral-1 systems are robust and reliable. (This assessment area is primarily reported by PEO C4I.)

The full hierarchy of assessment areas is represented next in **Table 1**.

Table 1. MDA Assessment Areas and Structure.

System Performance
Technical Performance
Information Retrieval
Information Processing
Information Sharing
Operator Configurable
Interoperability
Operations Support
System Utility
Standards and Guidelines
Warfighter Acceptance
System Utility
Human-System Interaction
System Usage
System Training
Automation
Alerts
Information Processing
Smart Pull
System Management and Security

Warfighter Performance
MDA Mission
Mission Understanding
Mission Acceptance
Unit Performance
Manning
Activities
Training
Human Performance
Tasks
Training

Operations Performance
Knowledge Processes
Information Retrieval
VoI Development
VoI Tracking
Information Sharing
ISR
Planning
Execution
PED
MIO
Planning
Execution
Assessment

Organization/Guidance
MDA Compatibility
Organization Alignment
Process Alignment
MHQ/MOC Compatibility
Organization Alignment
Process Alignment
Agreements
Information Sharing
Shared Operations
Guidance
CONOPS
TTP/SOP
Standing Orders

System Supportability and Readiness
PEO Provided

Capability indicators (or assessment metrics) have been defined for each of the Assessment Areas. These indicators include both attributes and their measures taken from those used for the Naval Network Warfare Command (NAVNETWARCOM) Capabilities Based Analyses for NCO, command and control (C2), and BA. Section 14.0 presents this full attribute structure.

Table 2 shows the attributes used for MDA assessment; not all are used for each Assessment Area. The principal indicators are Effectiveness and Military Utility.

Table 2. MDA Capability Indicators.

Area	**Effective**	**Utility**	Area	**Effective**
Systems	Accessible Capable Reliable Usable	Improved Needed Applicable Wanted	Warfighter	 Capable Reliable
Operations	Accessible Capable Reliable		Organization /Guidance	Accessible Capable Usable

Specific measures and data are defined for each of the capability indicators. Examples are shown in Table 3 and the full list is in Section 14.0.

Table 3. MDA Assessment Metrics Example.

	MOE MOP or MOU	
Spiral-1 System Performance (each system)		
Technical Performance	***Improved**: -5 to +5 rating of improvement over existing systems, by system aspect.* ***Needed**: system fills a gap in existing capabilities, Y/N.* ***Applicable**: system is applicable to MDA activities, by activity, Y/N.* ***Wanted**: -5 to +5 rating of operator desire to have system available.*	
Information Retrieval	**Accessible**: roll-up of information accessibility. **Available:** % of time information is available. **Efficient**: number of steps to access information.	
	Capable: roll-up of capability to retrieve required information. **Sufficient:** % of information needed for assessment. **Timely**: time required to retrieve information.	

Metric Attributes are shown in bold and their measures in plain text. Use of the structure presented in Table 3 provides a consistent approach to MDA assessment and reporting across test venues. This structure will be used to correlate and fuse results from a variety of sources throughout the life of the assessment program.

3.2 Data Collection

The data analyzed in this assessment were collected during multiple site visits and several Spiral -1 system test events:

1. Workflow analysis and Process Engineering Workshop (PEW)
    a. An overview of MDA activities was conducted during site visits to NAVCENT, ONI, Second Fleet, Third Fleet, Fifth Fleet, and Sixth Fleet. The workflow for MDA as currently executed was documented in these visits (see Appendix 1).
    b. The workflow was validated in the PEW held at the Naval Postgraduate School, Monterey, CA, 15-17 Jan 2008.
    c. The workflow was mapped to the MHQ w/MOC core processes in a workshop in Norfolk, VA, in 29 January 2008.
2. TRRLOE (Technical Risk Reduction Limited Objective Experiment)
    a. Held at SPAWAR, Lab 140, San Diego, CA, 2-6 June 2008.
    b. First simultaneous testing of multiple MDA technologies using Fleet participants
3. VBSS (Visit Board Search and Seizure) School:
    a. Held in San Diego, CA, 19 June 2008
    b. Observed EMIO usage and effectiveness
4. Trident Warrior 08
    a. Held aboard multiple Navy ships to test a myriad of newly developed technologies and policies, 15 Jun to 15 July 2008
5. Empire Challenge 08
    a. Held at China Lake Naval Station and in San Francisco Harbor as well as multiple other multiple sites, 7-31 July 2008
6. FAIRGAME:
    a. Held at simultaneous, multiple sites (NMIC, NAVCENT, PACFLT, MIFCPAC, MIFCLANT, SSC-SD, and NCIS MTAC), 15-18 July 2008
    b. Used as the primary source for COMOPTEVFOR to perform the Quick Reaction Assessment (QRA) on all MDA technologies

The data gathered in these venues were largely qualitative – including survey comments, chat logs, data collectors' observations, and interview notes – though some quantitative survey data were also collected. As noted above, the data largely concerned the Spiral-1 systems evaluated in most of these venues. However, data were also collected on other systems with potential MDA utility. In sum, the systems assessed were: CMA, E-MIO Wireless, FASTC2AP, Global Trader, Google Earth, LiNX, MAGNET, MASTER, MDA DS COI, MIDAS, PANDA, and Tripwire.

3.3 Analysis Method

The data were aggregated across all venues. Each datum was assigned to one or more areas (e.g., System Performance) of the assessment framework (depicted in Table 1) at

the lowest level of detail (e.g., Technical Performance, or sub-sub-areas). Each item in each category was rated to indicate that it described a strength (score = 3), a concern (score = 2), or a deficiency (score = 1) in an MDA system, suite of systems, or deployment concept for systems. Items scored as concerns (2) were relatively minor or could be addressed through revisions to training or interface design. Items scored as deficiencies (1) concerned missing or inoperable functions critical to the MDA mission. Average scores were computed for each assessment area. These scores focused our interpretation of the qualitative data. We have given special emphasis to describing reported deficiencies.

It is important to note that many of the reports are from a single source and, thus, may reflect the personal biases of those sources. Note also that the quantitative findings reported here were developed by the NPS research team from qualitative reports, and thus reflect our interpretation rather than the interpretation of diverse operational experts or technology experts.

In the next sections, we summarize our findings from each of the assessment areas. Following this, , we present recommendations based on these findings., and then describe the findings in detail.

4.0 MDA Capabilities Results Summary

4.1 Introduction

This section presents a qualitative and quantitative summary of MDA capabilities within the assessment areas included in the assessment framework developed for this effort. It summarizes findings across the assessment venues. The data that support these summaries are presented in subsequent chapters.

The data presented here comprise a compilation of 194 observations, warfighter comments, and survey results. These were each assigned to one or more of the relevant assessment sub-areas. Many items were placed in multiple categories, resulting in a total of 304 assessments. Items were scored on the three-point scale described above. Average scores drove interpretation of the qualitative data.

4.2 Results by Assessment Area

The data generated across the MDA assessment venues focused on the use of MDA Spiral-1 technologies for developing and tracking VOIs and conducting MIO operations. Accordingly, most of the data were categorized in the system performance assessment area (219 items) and the operations performance assessment area (70 items). In both areas, the average assessment score was relatively high: 2.4 out of 3. No items concerned warfighter performance independent of the MDA technologies, and no assessment is made in this area. Only eight items concerned the organization/guidance assessment area, and seven items concerned the system supportability and readiness area. Assessment scores were lowest in these low-frequency categories, largely due to overall concerns about the utility and supportability of new technologies from organizations being tasked with the new MDA mission. The frequency of reference to Spiral-1 and other MDA technologies is presented in **Table 4**.

Table 4. Distribution of data by assessment area.

Area	Items	Avg Score
Operations Performance	70	2.4
Organization/Guidance	8	2.1
System Performance	219	2.4
System Supportability and Readiness	7	2.0
Total / Average	304	2.4

The data, which include warfighter comments, observations, interview notes, and survey results, specified 123 strengths of the tested MDA systems, 166 concerns, and 15 deficiencies (see **Table 5**). Ten deficiencies concerned System Performance, and five

concerned Operations Performance. Because deficiencies are the most critical data, we address these in depth in the relevant assessment areas, below.

Table 5. Distribution of data by score by assessment area.

Count of Score	**Score**			
Assessment Area	**1: Deficiency**	**2: Concern**	**3: Strength**	**Total**
Operations Performance	5	33	32	70
Organization/Guidance		7	1	8
System Performance	10	119	90	219
System Supportability and Readiness		7		7
Total	15	166	123	304

We turn now to a qualitative assessment of each assessment area for which there was data.

4.2.1 System Performance

Of 219 items that concerned System Performance, 10 specified potential deficiencies of MDA system performance. Three of these concerned the inability to specify baselines against which to compare observed vessel behavior. Two items concerned perceived inadequacy of data quality and availability and two items concerned lack of connectivity of MIO technology. The remaining three items concerned specific features, data sharing, or security. Because deficiencies are particularly important in assessment, we present the detailed comments here.

Table 6. Potential deficiencies regarding System Performance.

Sub-Sub-Area	Technology	Item
System Performance: System Management and Security: System Management and Security	CMA	CMA: Users sometimes lost track of the original security classification of the information they wished to disseminate. This increased the likelihood of a security violation as a result of passing classified information on the wrong domain.
System Performance: Technical Performance: Information Sharing	Google Earth	Google Earth has no embedded collaboration tool included, thus it was not possible to send information from Google Earth to other systems.
System Performance: Automation: Alerts	All Spiral-1	Spiral-1 did not automatically establish or display threat assignments based upon a user-defined alert.
System Performance: Automation: Alerts	CMA & FASTC2AP	Spiral-1 tools did not provide additional capability to establish baseline normal civil maritime operations worldwide and threat assessment criteria. CMA and FASTC2AP could alert based upon a geographic point/area/proximity, but did not support alerts employing algorithms based upon baseline maritime operations.
System Performance: Operations Support: System Utility	E-MIO Wireless	Tactical EMIO System (TES) - Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not storing enough to transmit data when team members were below decks. (VBSS School)
System Performance: Operations Support: System Utility	E-MIO Wireless	Tactical EMIO System (TES) - While mobility of the Tactical EMIO Device (TED) was a clear advantage, enabling the collection of data from multiple locations within the vessel, one limitation noted was that the TED must be within the vicinity of the Tactical EMIO Maritime PC (TEMP) to download the data captured. Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not strong enough to transmit data when team members were below decks. The Maritime BGAN EMIO Terminal (MBET) device, in turn, failed to transfer data due to environmental issues and weak RF Signal range of the commercial satellite. Contractors eventually departed the target vessel and drove inland with the TEMP and MBET device to acquire a stronger signal. The MBET link was then acquired and successfully transmitted data from the TEMP device. Contractors asserted that the satellite connectivity will not be a concern in the current AOR. Also, the boarding officer was not able to demonstrate the transfer of data via the Maritime BGAN EMIO Terminal (MBET) due to the satellite connectivity. (VBSS School)
System Performance: Automation: Alerts	All Spiral-1	The ability to capture and store baseline/normal maritime movement patterns was not observed. Spiral-1 tools did not alert users to deviations from normal route or behavior patterns.
System Performance: Technical Performance: Information Retrieval	CMA	The user's ability to monitor vessel, person, and cargo data was severely degraded by gaps in track data coverage. When a node's CMA server was down, or data was not transmitted, the data not received was not recoverable. The Naval Research Laboratory (NRL) limited the National Technical Means (NTM) data source

		input to CMA to 14 hours per day and filtered the data that was provided. This resulted in a gap of data which had a negative impact across all AORs.
System Performance: Technical Performance: Information Sharing	All Spiral-1	There were significant differences in information available at different nodes.

Some 119 items expressed reparable concerns with MDA systems. By far the largest group of these (33 items) addressed the completeness, correctness, conflicts, and timeliness of data or data processing. Usability of maps, search, alerts, and other features was cited in 24 items. Some 20 items addressed problems with training availability, fit to local needs, or speed. Operational utility was a concern in 7 cases, and the redundancy of technologies was an issue in 5.

Of the 90 strengths cited in operator comments, observations, and survey results (see **Table 5**),
27 concerned operational utility for VOI detection and tracking and for MIO operations. Usability of search, maps, and other features accounted for 18 items. The speed of training (6 items) was also an indirect validation of the usability of the technologies. Nine items concerned the value of data fusion capabilities of these technologies. The speed of the technologies was cited in 6 items.

4.2.2 Operations Performance

Of 70 items that concerned Operations Performance, five were potential deficiencies. All but one item concerned E-MIO connectivity (reception or transmission) problems. The remaining item concerned gaps in track coverage by CMA due to failures of CMA servers. (Note that one of the five items in **Table 7** was coded in two assessment categories).

Table 7. Potential deficiencies regarding Operations Performance.

Sub-Sub-Area	Technology	Item
Operations Performance: Knowledge Processes: VoI Development & Operations Performance: MIO: Execution	E-MIO Wireless	Tactical EMIO System (TES) - While mobility of the Tactical EMIO Device (TED) was a clear advantage, enabling the collection of data from multiple locations within the vessel, one limitation noted was that the TED must be within the vicinity of the Tactical EMIO Maritime PC (TEMP) to download the data captured. Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not strong enough to transmit data when team members were below decks. The Maritime BGAN EMIO Terminal (MBET) device, in turn, failed to transfer data due to environmental issues and weak RF Signal range of the commercial satellite. Contractors eventually departed the target vessel and drove inland with the TEMP and MBET device to acquire a stronger signal. The MBET link was then acquired and successfully transmitted data from the TEMP device. Contractors asserted that the satellite connectivity will not be a concern in the current AOR. Also, the boarding officer was not able to demonstrate the transfer of data via the Maritime BGAN EMIO Terminal (MBET) due to the satellite connectivity. (VBSS School)
Operations Performance: Knowledge Processes: VoI Tracking	CMA	The user's ability to monitor vessel, person, and cargo data was severely degraded by gaps in track data coverage. When a node's CMA server was down, or data was not transmitted, the data not received was not recoverable. The Naval Research Laboratory (NRL) limited the National Technical Means (NTM) data source input to CMA to 14 hours per day and filtered the data that was provided. This resulted in a gap of data which had a negative impact across all AORs.
Operations Performance: MIO: Execution	E-MIO Wireless	Tactical EMIO System (TES) - Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not storing enough to transmit data when team members were below decks. (VBSS School)
Operations Performance: MIO: Execution	E-MIO	There were no positions provided with the latent print messages and for the cave collection, there was no Seek ID Global Positioning System (GPS) reception and therefore no position was included in the biometric messages.

Of 33 items coded as concerns (i.e., a score of 2), the most frequent themes were the completeness, correctness, conflicts, timeliness of data and data processing (12 items), usability (10 items), and training (5 items).

Of 32 items coded as strengths, 13 concerned operational utility for VOI; 10 concerned usability; 4 focused on the utility of alerts; and the rest addressed miscellaneous issues.

4.2.3 Warfighter Performance

No items concerned warfighter performance independent of the MDA technologies, and thus no assessment is made in this area.

4.2.4 Organization/Guidance

Very few items (8 in total) concerned the assessment area of Organization and Guidance. Of these, none rose to the level of a potential deficiency.

Seven items were coded as concerns. Two each concerned the constraints imposed by policies and agreements; coordination of MDA execution and ONI intelligence processes; and training. One addressed the challenge of customizing solutions to fit the local missions of organizations.

One item was scored as a strength (i.e., a score of 3). It concerned the alignment of MDA tasks with MHQ w/ MOC processes in the Process Alignment Workshop described in section Appendix B: Process Engineering & Alignment Workshop Results (section 8.0).

4.2.5 System Supportability and Readiness

Seven items addressed System Supportability and Readiness. All of these were areas of concern, either regarding the competency or size of staff (4 items), or potential deficiencies in infrastructure (2 items) or variance between facilities (1 item) that might hinder fielding and use of MDA solutions.

4.3 Results by Assessment Sub-Area

In this section, we summarize findings in each assessment sub-area. A summary of the quantitative assessment is presented in Table 8, followed by a qualitative assessment that summarizes the strengths, concerns, and deficiencies observed in the various MDA assessment venues.

Note, in the quantitative assessment, that areas of greatest concern (lowest average scores) were Operations Performance for MIO, several areas of Organization/Guidance (Guidance, MDA Compatibility, and System Management and Security), and System Supportability and Readiness. The most highly rated sub-areas were Operations Performance: Knowledge Processes, Organization/Guidance: MHQ/MOC Compatibility, and System Performance: Operations Support. Finer-grained categorization, a synopsis, and a score for each item are presented in later sections of this report.

Table 8. Average assessment scores by sub-area.

Assessment Sub-Area	Average score
Operations Performance: Knowledge Processes	2.5
Operations Performance: MIO	1.8
Organization/Guidance: Agreements	2.0
Organization/Guidance: Guidance	2.0
Organization/Guidance: MDA Compatibility	2.0
Organization/Guidance: MHQ/MOC Compatibility	2.5
System Performance: Automation	2.4
System Performance: Operations Support	2.5
System Performance: System Management and Security	2.0
System Performance: Technical Performance	2.3
System Performance: Warfighter Acceptance	2.4
System Supportability and Readiness	2.0
Average	2.4

4.3.1 System Performance: Technical Performance

Sub-Sub-Area	Total
System Performance: Technical Performance: Information Processing	1
System Performance: Technical Performance: Information Retrieval	54
System Performance: Technical Performance: Information Sharing	21
System Performance: Technical Performance: Interoperability	5
Average	81

The majority of the 81 items concerning System Performance: Technical Performance involved Information Retrieval (54 items), all but 30 of which addressed concerns (i.e., score of 2) about the completeness, correctness, conflicts, timeliness of data and data processing. Usability strengths and concerns were the topic of 8 items. Also noted, with 5 items each, were data fusion (generally a strength) and speed of data processing (which received mixed assessments). The remaining items addressed various issues.

Of the remaining items, 21 concerned Information Sharing. More specifically, 7 addressed the completeness, correctness, conflicts, timeliness of data and data processing. Three each concerned data sharing and transmission.

Five items addressed Interoperability of systems. Of these items, three addressed requirements for specific software (e.g., Java, Direct-X), and two concerned the availability of data within or between nodes.

One item addressed Information Processing, specifically the need for automated statistical analysis of data gaps to identify potential new sources of information and drive new collections. This capability – data-driven collection planning – is being developed in research efforts for ground warfare, and could be extended to MDA.

4.3.2 System Performance: Operations Support

Of 21 items that concerned System Performance: Operations Support, 20 concerned the utility of specific technologies to operations. As noted above, E-MIO technology exhibited a potential deficiency with respect to connectivity. Most items in this area were strengths or concerns about the general value of these tools. One item concerned the lack of TTPs and SOP (Standards and Guidelines) for applying MDA technologies.

4.3.3 System Performance: Warfighter Acceptance

Some 85 items addressed Warfighter Acceptance of specific technologies. Of these, 41 concerned Human-System Interaction, the majority focusing on usability of agents, alerts, briefs, help, maps, menus, and search. Five of these concerned CMA's data fusion capabilities, which were viewed as a strength in most cases. Training was addressed in 22 items, which was seen as fast but often incomplete. System Utility was addressed by 18 items, with an emphasis on acceleration of operational tasks, and benefits to situational awareness. However, MDA DS COI, LiNX, and Google Earth were each viewed once with concern (i.e., a score of 2) for being redundant with other solutions. Strategies for using the systems were seen to be lacking in four cases in an area we call System Usage.

4.3.4 System Performance: Automation

Automation was addressed in 27 items. Of these, 26 concerned Alerts, specifically their strong operational utility but mixed usability. One item, concerning Information Processing, addressed MASTER's strong automation to capture data on VOIs, relative to current solutions.

4.3.5 System Performance: System Management and Security

Of five System Management and Security issues, 4 were concerns about keeping systems up and running, and one – a potential deficiency – concerned loss of the original security classification of information to be disseminated.

4.3.6 Operations Performance: Knowledge Processes

VOI Development was the focus of 52 of the 62 items concerning Operations Performance: Knowledge Processes. In this area, usability (17 items), operational utility

(14 items), and the completeness, correctness, conflicts, timeliness of data and data processing were the most frequent topics.

VOI Tracking accounted for the remaining 10 items, and similar concerns arose in this area; completeness, correctness, conflicts, timeliness of data and data processing (4 items), and mixed usability (2 items) were the most frequently cited issues.

4.3.7 Operations Performance: MIO

In the area of MIO Execution, inadequate training was a concern in 3 of 8 cases; inadequate connectivity was a potential deficiency in 2.

4.3.8 Organization/Guidance: MDA Compatibility

The alignment of ONI with MDA activities was a concern in 2 items.

4.3.9 Organization/Guidance: MHQ/MOC Compatibility

Two items concerned compatibility of MDA and MHQ with MOC. Process Alignment between MDA and MHQ with MOC was seen as a strength in one item, due to the Process Alignment Workshop. However, local Organization Alignment with MDA, that is, the flexibility of MDA processes to local needs, was a concern in one case.

4.3.10 Organization/Guidance: Agreements

Two items concerned the assessment area Organization/Guidance: Agreements, and both were concerns (i.e., rating of 2) about restrictions imposed by data sharing agreements about classified information or data concerning U.S. citizens.

4.3.11 Organization/Guidance: Guidance

Two items specified concerns (i.e., rating of 2) about the need to develop better MDA CONOPS and TTP/SOP.

4.3.12 System Supportability and Readiness

Seven items concerned System Supportability and Readiness. Of these, 4 were concerns (i.e., rating of 2) about the number or competency of staff, and 3 identified concerns about the adequacy of infrastructure to support MDA technologies generally.

4.4 Results by Technology

In this section, we summarize the scores for each MDA technology cited in the findings – including Spiral-1 technologies and others – at the lowest assessment level. For further detail concerning each technology, we refer the reader to the reports sections, below, in which we present findings in each of the assessment areas.

The majority of the data gathered across venues concerned a specific technology (a total of 257 items), usually CMA (136 items). A minority of the data concerned no specific MDA technology, or an unspecified suite of technologies (47 items) (see **Table 9**). Note that the list of technologies includes some systems that are not Spiral-1 products, but that were evaluated in the various MDA assessment venues.

Those technologies that scored lowest, on the average (see **Table 9**), were Global Trader, for perceived incompleteness of data and lack of data replication; MAGNET, for lack of data due to data sharing agreements concerning U.S. citizens; MDA DS COI for lack of usability or training; and E-MIO wireless for connectivity problems. Those that scored highest were Tripwire, for its alerting and provision of contextual information, and PANDA, for the operational utility of alerts and quality of explanations of deviations that it presented.

Table 9. Distribution of data by technology.

Technology	Frequency	Average Score
All Spiral-1	47	2.1
CMA	136	2.4
E-MIO Wireless	23	2.1
FASTC2AP	13	2.4
Global Trader	5	2.2
Google Earth	10	2.5
LiNX	5	2.4
MAGNET	2	2.0
MASTER	33	2.3
MDA DS COI	5	2.0
MIDAS	5	2.6
PANDA	13	2.9
Tripwire	7	2.9
Total/Avg	304	2.4

A more detailed assessment is presented in **Table 10**, which indicates the average scores for MDA technologies at the finest level of assessment detail.

Table 10. Average assessment scores for MDA technologies.

Sub-Sub-Area	CMA	E-MIO Wireless	FASTC2AP	Global Trader	Google Earth	LiNX	MAGNET	MASTER	MDA DS COI	MIDAS	PANDA	Tripwire	All MDA Tech	Average
Operations Performance: Knowledge Processes: VoI Development	2.5	1.0		2.0	3.0			2.1	2.0	3.0	3.0	3.0	2.5	2.5
Operations Performance: Knowledge Processes: VoI Tracking	2.3							3.0						2.4
Operations Performance: MIO: Execution		1.8												1.8
Organization/Guidance: Agreements: Information Sharing							2.0			2.0				2.0
Organization/Guidance: Guidance: CONOPS	2.0													2.0
Organization/Guidance: Guidance: TTP/SOP	2.0													2.0
Organization/Guidance: MDA Compatibility: Organization Alignment													2.0	2.0
Organization/Guidance: MHQ/MOC Compatibility: Organization Alignment													2.0	2.0
Organization/Guidance: MHQ/MOC Compatibility: Process Alignment													3.0	3.0
System Performance: System Management and Security: System Management and Security	1.7												2.5	2.0
System Performance: Automation: Alerts	2.3		2.3					2.5			3.0	3.0	1.3	2.3
System Performance: Automation: Information Processing								3.0						3.0
System Performance: Operations Support: Standards and Guidelines													2.0	2.0
System Performance: Operations Support: System Utility	3.0	2.0	3.0	3.0	3.0	2.0		3.0				3.0	2.3	2.6
System Performance: Technical Performance: Information Processing													2.0	2.0

Sub-Sub-Area	CMA	E-MIO Wireless	FASTC2AP	Global Trader	Google Earth	LiNX	MAGNET	MASTER	MDA DS COI	MIDAS	PANDA	Tripwire	All MDA Tech	Average
System Performance: Technical Performance: Information Retrieval	2.3			2.0	3.0	2.5		2.2		3.0	2.5	2.0	2.3	2.3
System Performance: Technical Performance: Information Sharing	2.2	3.0		2.0	1.5			3.0	2.0	2.0	3.0		1.8	2.2
System Performance: Technical Performance: Interoperability	2.0		2.0		2.0									2.0
System Performance: Warfighter Acceptance: Human-System Interaction	2.5	2.0	2.3		3.0			2.0	2.0		3.0		2.0	2.4
System Performance: Warfighter Acceptance: System Training	2.5	2.4						2.0	2.0				2.0	2.3
System Performance: Warfighter Acceptance: System Usage	3.0											3.0	2.5	2.8
System Performance: Warfighter Acceptance: System Utility	2.8				2.0	2.5	2.0	2.5	2.0		3.0	3.0		2.6
System Supportability and Readiness: System Supportability and Readiness													2.0	2.0
Average	2.4	2.1	2.4	2.2	2.5	2.4	2.0	2.3	2.0	2.6	2.9	2.9	2.1	2.4

To make a more focused assessment of operational utility of systems, we computed the average sum of scores for strengths and concerns[1] about systems. Several MDA technologies appear to have particularly high or low operational utility, under this analysis (see

Table 11). FASTC2AP, Global Trader, PANDA, Tripwire, and CMA received high marks for operational utility. MDA DS COI, E-MIO Wireless, and MAGNET received low marks for operational utility.

Table 11. Average sum of concern and strength scores per technology.

[1] The value here is computed as the sum of all scores for concerns (each valued at 2 points) and strengths (3 points) divided by the total frequency of these scores for items in these categories: System Performance categories for Operations Support: System Utility, and Warfighter Acceptance: System Utility. Note that scores for potential deficiencies were excluded from this analysis, as were scores in all other assessment categories.

MDA Technology	Avg Sum of Scores
FASTC2AP	3.0
Global Trader	3.0
PANDA	3.0
Tripwire	3.0
CMA	2.8
MASTER	2.7
Google Earth	2.5
LiNX	2.3
MDA DS COI	2.0
E-MIO Wireless	1.5
MAGNET	n.a.

An additional analysis was conducted to help the reader assess the impact of specific systems regarding fulfillment of MDA capability requirements (see

Table 12). Spiral-1 technologies must help the Navy to fulfill several MDA capabilities: monitor, collect, fuse, analyze, and disseminate. One technology – E-MIO Wireless – has a low assessment score (above, driven by connectivity deficiencies) and it addresses only one MDA capability. This should raise concern about the value of this technology, and focus investment (or disinvestment) decisions on it.

Low assessment scores (of 2.0), in Table 11, are also a concern with respect to MAGNET and MDA DS COI. However, these technologies address multiple MDA capabilities. Strengths in one area may compensate for concerns in others.

Note that all MDA capabilities are addressed by more than one technology. Thus, the issues identified with respect to any one technology do not necessarily indicate a capability gap. More specifically, three SP-1 technologies (CMA, MAGNET, and Tripwire) address all of these capabilities. Three technologies (Global Trader, DS/COI, and FASTC2AP) address most capabilities. Three technologies address only one capability (E-MIO: Collect; Google Earth: Disseminate; and LiNX: Collect).

A finer-grained understanding of the implications of findings on MDA capabilities can be had by considering the mapping of technologies to the performance thresholds that each technology must achieve (see section 16.0).

Table 12. Mapping of SP-1 Technologies to MDA Capabilities.

Capability	CMA	E-MIO Wireless	Global Trader	Google Earth	LiNX	MAGNET	Data Sharing COI	Tripwire	FASTC2AP
Assessment score	2.4	2.1	2.2	2.5	2.4	2.0	2.0	2.9	2.4
Monitor	X		X			X	X	X	X
Collect	X	X	X		X	X	X	X	X
Fuse	X					X		X	X
Analyze	X		X			X	X	X	
Disseminate	X		X	X		X	X	X	X

5.0 MDA Capabilities Recommendations

In this section, we draw recommendations from the findings, discussed in previous sections. These recommendations concern fielding and support, technology usability, technology functionality, data quality, training, organizational interoperability, and future MDA assessment activity. They are organized into three categories of the assessment framework, and an additional category concerning the programmatics of MDA assessment.

5.1 System Supportability and Readiness

1. ***Strong technologies:*** PEO C4I and OPNAV should press forward with development and fielding of several technologies that received high marks for operational utility: FASTC2AP, Global Trader, PANDA, Tripwire, and CMA[2].

2. ***Weaker technologies:*** OPNAV should evaluate the expressed concerns, deficits, and return on investments for several technologies that received low marks for operational utility: MDA DS COI, E-MIO Wireless, and MAGNET.

3. ***Fielding sites:*** OPNAV should consider placing technologies in reach-back facilities (e.g., at ONI rather than at NAVCENT) with robust technical support and operator competence for those technologies that have high utility but low accuracy, reliability, or usability.

4. ***Fielding/support process:*** OPNAV and PEO C4I should ensure and advertise competent fielding and support for MDA technologies. This may involve

[2] This list was arrived at by computing the average weighted sum of scores for items in two categories concerning operational utility: System Performance categories for Operations Support: System Utility, and Warfighter Acceptance: System Utility. Scores for potential deficiencies were excluded from this analysis.

educating these organizations about the processes for surveying infrastructure (e.g., the adequacy of power supplies and server space), configuring or customizing technologies to local needs, specifying technical support requirements, fulfilling them, and identifying and addressing shortfalls.

5.2 System Performance

5. ***Usability:*** OPNAV and PEO C4I should systematically analyze the usability of MDA technologies – specifically programmable agents, maps, search features, graphs, alerts, and briefing products – to ensure that (1) the cost in errors and response time is estimated, (2) design modifications are prioritized accordingly and are funded, and (3) training enables operators to work around persistent usability problems. In MDA assessment events, CMA, MASTER, FASTC2AP, MDA DS COI, and E-MIO all had usability issues that raised concern.

6. ***Redundant functionality:*** OPNAV and PEO C4I should evaluate reports of redundancy of MDA technologies with each other and with existing systems. Fielding decisions, TTPs, and training should resolve these redundancies.

7. ***Baseline specification functions:*** OPNAV and PEO C4I should ensure that technologies with alert/alarm capabilities enable the user to specify baseline behaviors for traffic in different regions. Without this function, alerts lose much of their value.

8. ***Data sources:*** OPNAV should identify, develop, and link to critical data sources. For example, data sharing agreements are required to provide data concerning U.S. persons.

9. ***Data source education:*** OPNAV and PEO C4I should ensure that operators of new systems understand which data sources feed those systems, the reliability of those sources, which expected data sources do not feed those systems, and the implications of both for analyzing results. These explanations should identify the reason for data gaps, e.g., lack of institutional or international agreements to access data, lack of a connection to the data source, lack of data replication, or data loss during system failures. In MDA assessment events, unreliable sources or systems produced gaps in CMA track coverage; lack of data replication produced incomplete data in Global Trader; connectivity issues hindered use of E-MIO (e.g., below decks); and MAGNET data were sparse per policies about handling data concerning U.S. persons.

10. ***Common Data:*** OPNAV should analyze and resolve significant differences in data sets between users who must coordinate their activities.

11. ***Training:*** OPNAV should implement a dedicated course of instruction concerning MDA TTPs, SOPs, and the role of MDA technologies in them, and include it in the Navy Training System Plan (NTSP). Ideally, this training will be customized to local missions and conditions.

5.3 Organization/Guidance

12. ***Process interoperability:*** OPNAV should evaluate and revise the emerging process architectures for MHQ with MOC, ONI, and other organizations to ensure that they support MDA tasks, and that they can be customized to the conditions of MDA work in the varied Navy Areas of Operations. This analysis may entail developing MDA use cases or scenarios against which to test process architectures, and these use cases can serve double duty as exercise and training scenarios.

13. ***Information flow impedance:*** OPNAV and PEO C4I should assess the impact of new technologies, procedures, and organizational structures on the rate of information flow between organizations, and between elements of organizations. New technologies have the potential to raise the information output of some organizations (e.g., ONI) well above the input and processing capacities of the organizations they support (e.g., NAVCENT).

5.4 Assessment

14. ***MDA operational baseline:*** To estimate the return on investment in MDA systems requires that we define the baseline of MDA capabilities (e.g., the number of VOIs developed and tracked per unit time). This baseline might be estimated by operational experts. However, more reliable data will arise from direct observation of the effectiveness of current, fielded technologies for MDA missions. We recommend that observational data be gathered concerning the current MDA baseline.

15. ***MDA system alternatives:*** The return on investment for MDA assessment may be increased if experimentation and observation address some promising systems outside the Spiral-1 suite. Such systems include CMMA, NEPTUNE, GALE-Lite, Palaemon, PANDA, and Sea Watch. Evaluation of such systems is essentially a high risk/high return investment in the portfolio of MDA assessment activities.

16. ***MDA assessment scenarios:*** OPNAV and PEO C4I should develop exercises that train and test MDA capabilities (technologies, TTPs, organizations, etc.), with a particular focus on handling realistic numbers of white vessels. Design these exercises to answer at least these questions: Can we develop a VOI and identify it among many vessels almost identical to it? Can we communicate securely and confidentially with a single ship among many ships in an area? Can we coordinate

our actions in a crowded field of internationally flagged white vessels? Can we manage and address costs of delay to commercial shipping (estimated by NORTHCOM at $10,000/hour) and erroneous actions (e.g., damage or destruction of internationally flagged vessels)?

17. ***MDA process modeling:*** OPNAV should ensure that future assessments use measures that support computational, "what if" modeling of the impact of new technologies, processes, manning, and organizational structures. Such measures should represent the speed-accuracy tradeoff curve for analysis, decision making, and action (throughput) given varied missions, staff size and competency, and related factors. By reusing these measurements in models, the Navy will multiply the answers it can extract from scant assessment data, and thus increase its return on every dollar spent on assessment.

6.0 System Performance Results

The assessment area "system performance" concerns the performance of MDA technologies, including Spiral-1 technologies. The components of this assessment area concern the technical performance of systems, the support they provide to operations, warfighter acceptance of the systems, automation of important functions, and system management and security.

The key data concerning the System Performance assessment area are presented in **Table 13**. This table (like those in subsequent sections) presents findings sorted by assessment area, technology, and assessment score, in that order. The Comments column concisely summarizes the Item relevant to the Area. The Technology and Venue columns indicate the object and source of the item, respectively. Note that any one Item could be coded in multiple Assessment Areas or concern multiple Technologies. Thus, some items are repeated in this table.

Table 13. System Performance Results.

Item ID	Area	Item	Comments	Score	Technology	Venue
220	System Management and Security: System Management and Security	Spiral-1 systems management was tested during FAIRGAME. No reliability or supportability issues were observed. The following maintenance issues were observed:	technical support	3	All MDA Tech	VBSS
223	System Management and Security: System Management and Security	ONI expresses concern about integration and accreditation.	technical support	2	All MDA Tech	VBSS
221	System Management and Security: System Management and Security	The NMIC CMA system suffered an unknown failure that rendered it unusable. An attempt by NRL to troubleshoot via remote access was unsuccessful. A technician arrived on-scene to conduct on-site troubleshooting and discovered a faulty hardware router and replaced it five hours later.	technical support	2	CMA	TW08
222	System Management and Security: System Management and Security	A potential issue is that the primary means of troubleshooting a CMA problem is for NRL to access the local system via remote web access. If the problem cannot be resolved remotely, NRL must dispatch a technician to the node. COMUSNAVCENT however, has a permanent SPAWAR Fleet Systems Engineering team representative onsite to resolve CMA hardware issues.	technical support	2	CMA	QRA
64	System Management and Security:	CMA: Users sometimes lost track of the original security classification of the information they wished to disseminate. This	opsec	1	CMA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
	System Management and Security	increased the likelihood of a security violation as a result of passing classified information on the wrong domain.				
271	Automation: Alerts	NAVCENT staff see value in technologies that trigger alerts concerning specific tracks.	operational utility	2	All MDA Tech	Workflow, PEW
204	Automation: Alerts	The ability to capture and store baseline/normal maritime movement patterns was not observed. Spiral-1 tools did not alert users to deviations from normal route or behavior patterns.	establishing baselines	1	All MDA Tech	VBSS
208	Automation: Alerts	Spiral-1 did not automatically establish or display threat assignments based upon a user-defined alert.	features	1	All MDA Tech	QRA
3	Automation: Alerts	The majority of users reported liking the ability that CMA gives them to leave an alert in a vessel file that can be used by other analysts. Users also reported being able to rely on pre-defined alerts to stay informed about vessels of interest. Regarding the timely attribute, users reported that query functions saved significant time. Specifically, it was helpful to be able to filter by location, time, vessel name and vessel attributes.	features	3	CMA	QRA
197	Automation: Alerts	CMA: Thirty-seven percent of users "agreed," 26% "strongly agreed," a32% indicated "N/A," and 5% "strongly disagreed" they liked the ability CMA gives to leave an "alert" in a vessel file that can be used by other analysts. Forty-two percent of users indicated "N/A," 26% "agreed," 21% indicated "disagree," and 11% indicated "strongly agree" that they could count on the pre-defined alerts in CMA to detect conditions of interest and that CMA pre-defined alerts helped them stay informed about VoIs. Forty-two percent of users indicated "N/A," 32% "agreed," 11% "disagreed," and 16% strongly agreed CMA pre-defined alerts were understandable.	operational utility	3	CMA	TW08
241	Automation: Alerts	It was easy for CMA users to associate tipper/ Intel information with the correct VOI. CMA showed recent alerts on the vessel and made it easy to see the tippers.	usability	3	CMA	TRRLOE
36	Automation: Alerts	Suggestions for Improvement and Useful Features. Both CMA users experienced difficulties using the alerting system as well as the hyper graph. Participants noted that when searching on CMA using a partial search, the system did not always pull up all tracks containing a portion of the name. One user recommended adding a feature to provide the capability to use range and bearing from a point in a circle to form a search area. This user also suggested including the ability to use a line or border to search for any track crossing a line rather than a box as is done in the current system.	usability	2	CMA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
173	Automation: Alerts	CMA Alerts: Was unable to set up alerts and trip wires to notify of transit. Information on cargo and individuals on the vessel was limited.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	VBSS
211	Automation: Alerts	Pre-defined alerts were not representative of current operational needs. CMA is not capable of providing user-defined alerts.	operational utility	2	CMA	TW08
214	Automation: Alerts	CMA - Three of four users during FAIRGAME did not think the alerting system in CMA was easy to understand. ("I might not have been trained well enough on using it but I did not find the alerting system especially helpful, save for the ability to save watch areas which is an easy system.") Regarding whether the alerting system in CMA was useful and relevant, users were either neutral or disagreed, e.g., "To set up the trips was not easy. Establishing the bounding boxes and setting up the search parameters was easy but needed further instruction on alert set up." (FAIRGAME)	usability	2	CMA	VBSS
206	Automation: Alerts	Spiral-1 tools did not provide additional capability to establish baseline normal civil maritime operations worldwide and threat assessment criteria. CMA and FASTC2AP could alert based upon a geographic point/area/proximity, but did not support alerts employing algorithms based upon baseline maritime operations.	establishing baselines	1	CMA	QRA
69	Automation: Alerts	FASTC2AP provides a basic user-defined anomaly detection capability.	operational utility	3	FASTC2AP	QRA
117	Automation: Alerts	Usability. The operator felt that FASTC2AP was difficult to learn resulting in the user having to try the agents multiple times in order to understand what each was providing in the way of results. The operator stated it was fairly easy to create agents, however understanding the results is difficult. It was easy to compose agents and to build alerts in order to fill RFIs, although the system could not provide the details required for some of the RFIs.	usability	3	FASTC2AP	VBSS
209	Automation: Alerts	FASTC2AP alerted the user, per user-defined alerts, when a vessel meets the alert thresholds. The user then conducted a threat analysis on the vessel. The Tripwire system will alert the user that there is a data element that meets search criteria.	alerts	3	FASTC2AP	QRA
178	Automation: Alerts	FASTC2AP has predefined alert agents and the facility for operators to define their own alerts. The agents were useful but understanding some of the agent results was difficult. This was due to agent templates being difficult to understand. Setting up new agents is difficult. The system is non-	usability	2	FASTC2AP	TRRLOE

Item ID	Area	Item	Comments	Score	Technology	Venue
		intuitive.				
212	Automation: Alerts	Change FASTC2AP alerts so SCONUM is Not Required. FASTC2AP has a number of pre-defined alert functions. Their use requires an ONI-assigned SCONUM, which when combined with a ship's name and its position becomes classified. The SCONUM also may not be available to coalition forces. This makes these alerts of limited use and could cause future security concerns. It is recommended that the alerts be rewritten to require ship names only or the Lloyd's identification number.	usability	2	FASTC2AP	TRRLOE
207	Automation: Alerts	Spiral-1 tools did not provide additional capability to establish baseline normal civil maritime operations worldwide and threat assessment criteria. CMA and FASTC2AP could alert based upon a geographic point/area/proximity, but did not support alerts employing algorithms based upon baseline maritime operations.	establishing baselines	1	FASTC2AP	QRA
199	Automation: Alerts	MASTER: Respondents agreed that MASTER's pre-defined alerting capabilities are superior to current methods and that MASTER's user-defined alerts supported accurate detection of conditions of interest. This capability was considered to be an excellent feature, able to respond to the dynamic maritime threat environment, assuming that users provide accurate rules for alerts.	operational utility	3	MASTER	TW08
200	Automation: Alerts	MASTER: One respondent wanted a way to see alerts for his rules only, not everyone's rules; another respondent noted that MASTER, unlike Sealink, cannot remember a search parameter, requiring the same search to be built each day, which is time consuming.	features	3	MASTER	TW08
63	Automation: Alerts	MASTER: MASTER provides a single source of tools which are superior to legacy, but users would prefer the two systems (MASTER and legacy) to interact. Users typically identified the correct tracks in their assigned scenarios, but various usability issues were observed. Some users questioned the completeness or accuracy of the information in MASTER's database. Several users used SeaLink to find information on a port and to correlate old ship names with new ship names. One user utilized the PMIC web page in attempting to determine the destination for a particular ship. Two users preferred ASA over MASTER because it is both faster and easier to use, not because it is more accurate than MASTER. Respondents agreed that they could count on the pre-defined alerts in MASTER to detect conditions of interest. Because alerts are not easy to set up using alert management and	data & processing completeness, correctness, conflicts, timeliness	2	MASTER	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		alert channels, one respondent recommended that alerts be based on completed searches and that an option be provided to save that search as an alert.				
176	Automation: Alerts	Tripwire, Alert: Simply unable to use. With more training am sure that too could be mastered	usability	2	MASTER	VBSS
45	Automation: Alerts	PANDA: Regarding predicting deviation, most users (85%) responded that detecting deviation is a useful capability and all users responded that alerting for deviation is a useful capability. Most users responded that the capability of classifying alerts into categories (86%) and that PANDA's classification of alerts (86%) were useful. User responses were mixed about whether PANDA's explanation for the deviation was useful. Information that users would communicate to others about deviations included % likelihood a vessel would deviate, context information such as ship parts/spares/repair, and crew change/illness (currently not available in PANDA), other vessels in the area, whether a vessel maybe a potential threat or information for a task.	operational utility	3	PANDA	TW08
201	Automation: Alerts	PANDA: Regarding deviation: All users responded that PANDA was effective at alerting for deviations and that PANDA's explanation for the deviation was reasonable and made sense. Most users indicated that it was easy to understand the explanation for the deviation (67% and 83% strongly agreed; others were neutral). Regarding prediction: Sixty-seven percent of users (67%) responded that PANDA was effective at representing predicted vessel behavior (others were neutral and disagreed).	operational utility	3	PANDA	TW08
203	Automation: Alerts	PANDA: Deviation: All users indicated that the following capabilities were useful - classifying alerts, allowing users to update the alert classification and provide feedback. Most users indicated that PANDA was effective at detecting deviations (85%, others = slightly effective and n/a), and all users indicated PANDA was effective at classifying alerts. All users also indicated that it was easy to change the classification for the deviation provided by PANDA and to explain the change. Identification of deviations in a similar area was deemed to be helpful (79% of users). Most users (93%) agreed that the ability to associate correlated deviations would be a useful feature to have in PANDA.	operational utility	3	PANDA	Workflow, PEW
218	Automation: Alerts	PANDA: All 12 users indicated PANDA would have a positive effect on their situation awareness. Users pointed to a variety of PANDA features that would support improved	operational utility	3	PANDA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
		SA, including an increase in understanding of normalcy and anomalous vessel behavior, alerting to behavior that would otherwise be missed, prediction related to ships inbound to US ports, understanding of vessel history, and potential support for "proactive" analysis.				
210	Automation: Alerts	FASTC2AP alerted the user, per user-defined alerts, when a vessel meets the alert thresholds. The user then conducted a threat analysis on the vessel. The Tripwire system will alert the user that there is a data element that meets search criteria.	alerts	3	Tripwire	QRA
90	Automation: Information Processing	Respondents mostly agreed that MASTER's capability to automatically acquire data on vessels of interest is superior to current data acquisition processes. MASTER's track analysis and graphing capabilities were among its strengths, but its archive database was often slow to respond to queries. MASTER was easy to use when creating new vessel tracks.	automated data analysis	3	MASTER	TW08
87	Operations Support: Standards and Guidelines	Current Standard Operating Procedures (SOP) and TTP do not address the new MDA Spiral-1 tools. OPNAV N3/N5 has developed an outstanding draft MDA SOP that, with further refinement and extensive Fleet feedback will provide the groundwork for all MDA nodes to employ the new technologies to their fullest extent. The SOP in its current version will assist the users in navigating through the different technologies, but requires feedback.	SOP and TTPs	2	All MDA Tech	QRA
259	Operations Support: System Utility	MIFCPAC will require MDA tools to discriminate between different types or activities of white vessels, e.g., US vs. foreign vessels in fisheries.	features for vessel type discrimination	3	All MDA Tech	Workflow, PEW
270	Operations Support: System Utility	NAVCENT leadership views positively the Spiral 2 initiative to combine the shore-based radars of many nations with AIS data. This capability would benefit operations and strengthen partnerships.	political utility of AIS data sharing	3	All MDA Tech	VBSS
269	Operations Support: System Utility	NAVCENT is concerned about the relevance of the technology effort to primary missions.	operational utility	2	All MDA Tech	VBSS
272	Operations Support: System Utility	NAVCENT staff see little value in technologies for data mining or fusion across multiple sources.	operational utility of data mining	2	All MDA Tech	Workflow, PEW
280	Operations Support: System Utility	ONI expresses concern about lack of functionality for data analysis and event prediction.	features for analysis	2	All MDA Tech	VBSS
286	Operations Support: System Utility	CINCPACFLEET has only one OPPLAN on which it needs to track white shipping, so the capability will be important but rarely used.	operational utility	2	All MDA Tech	Workflow, PEW
261	Operations Support:	MIFCPAC sees value in CMA, Google, and Global Trader.	features for vessel type	3	CMA	Workflow, PEW

Item ID	Area	Item	Comments	Score	Technology	Venue
	System Utility		discrimination			
265	Operations Support: System Utility	ONI sees value in several tools: CMA, TRIPWIRE, TAANDEM, FASTCAP, and EMIO wireless.	operational utility	3	CMA	Workflow, PEW
257	Operations Support: System Utility	MIO situation awareness was maintained at rear units.	operational utility for MIO SA	3	E-MIO Wireless	Workflow, PEW
266	Operations Support: System Utility	ONI is sees value in several tools: CMA, TRIPWIRE, TAANDEM, FASTCAP, and EMIO wireless.	operational utility	3	E-MIO Wireless	Workflow, PEW
84	Operations Support: System Utility	Tactical EMIO System (TES) - While mobility of the Tactical EMIO Device (TED) was a clear advantage, enabling the collection of data from multiple locations within the vessel, one limitation noted was that the TED must be within the vicinity of the Tactical EMIO Maritime PC (TEMP) to download the data captured. Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not strong enough to transmit data when team members were below decks. The Maritime BGAN EMIO Terminal (MBET) device, in turn, failed to transfer data due to environmental issues and weak RF Signal range of the commercial satellite. Contractors eventually departed the target vessel and drove inland with the TEMP and MBET device to acquire a stronger signal. The MBET link was then acquired and successfully transmitted data from the TEMP device. Contractors asserted that the satellite connectivity will not be a concern in the current AOR. Also, the boarding officer was not able to demonstrate the transfer of data via the Maritime BGAN EMIO Terminal (MBET) due to the satellite connectivity. (VBSS School)	connectivity	1	E-MIO Wireless	VBSS
121	Operations Support: System Utility	Tactical EMIO System (TES) - Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not storing enough to transmit data when team members were below decks. (VBSS School)	connectivity	1	E-MIO Wireless	QRA
264	Operations Support: System Utility	MIFCPAC argues that FASTC2AP may not be "viable" for its uses.	operational utility	3	FASTC2AP	TW08
267	Operations Support: System	ONI is sees value in several tools: CMA, TRIPWIRE, TAANDEM, FASTCAP, and EMIO wireless.	operational utility	3	FASTC2AP	Workflow, PEW

Item ID	Area	Item	Comments	Score	Technology	Venue
	Utility					
262	Operations Support: System Utility	MIFCPAC sees value in CMA, Google, and Global Trader.	features for vessel type discrimination	3	Global Trader	Workflow, PEW
263	Operations Support: System Utility	MIFCPAC sees value in CMA, Google, and Global Trader.	features for vessel type discrimination	3	Google Earth	Workflow, PEW
83	Operations Support: System Utility	The full potential use of LINX requires a shift in current NCIS investigative processes.	misc	2	LiNX	VBSS
97	Operations Support: System Utility	MASTER: Respondents agreed they could track vessels as needed. MASTER does a very good job of pulling vessel track history, provides named data that current systems do not, and facilitates vessel tracking with its graphical display and ability to compare tracks.	operational utility for tracking	3	MASTER	TW08
111	Operations Support: System Utility	Tripwire Contextual information on vessels of interest and persons of interest is outstanding.	fusion of data	3	Tripwire	VBSS
268	Operations Support: System Utility	ONI is sees value in several tools: CMA, TRIPWIRE, TAANDEM, FASTCAP, and EMIO wireless.	operational utility	3	Tripwire	Workflow, PEW
53	Technical Performance: Information Processing	Spiral-1 tools did not conduct statistical analysis of data gaps in order to identify potential new sources of information and drive new collections.	automated data analysis	2	All MDA Tech	n.a.
49	Technical Performance: Information Retrieval	Spiral-1 tools increased the user's ability to fuse vessel, people, and cargo data from interagency sources	fusion of data	3	All MDA Tech	QRA
25	Technical Performance: Information Retrieval	Many of the FAIRGAME users had experience in previous Operational Demonstrations (OD) as well as in Trident Warrior and noted that system information reliability continued to be a concern.	data & processing completeness, correctness, conflicts, timeliness	2	All MDA Tech	TW08
47	Technical Performance: Information Retrieval	The lack of commonality between nodes made the aggregation of information difficult. MDA Spiral-1 did not contain a central repository of worldwide vessel movement data. Differences in node metadata required additional research on the part of the user, increasing the time required to perform a mission.	data & processing completeness, correctness, conflicts, timeliness	2	All MDA Tech	QRA
77	Technical Performance: Information Retrieval	Large data latency was observed in littoral regions.	speed	2	All MDA Tech	TW08
1	Technical Performance: Information	The majority of users reported liking the ability that CMA gives them to leave an alert in a vessel file that can be used by other	usability of alerts	3	CMA	EC EMIO

Item ID	Area	Item	Comments	Score	Technology	Venue
	Retrieval	analysts. Users also reported being able to rely on pre-defined alerts to stay informed about vessels of interest. Regarding the timely attribute, users reported that query functions saved significant time. Specifically, it was helpful to be able to filter by location, time, vessel name and vessel attributes.				
5	Technical Performance: Information Retrieval	CMA is viewed as enhancing SA rapidly. Ninety percent of users either agreed or strongly agreed that they could maintain awareness of maritime activity through CMA. Forty-two percent of users "agreed," 26% "strongly agreed," 16% "disagreed," and 16% indicated "N/A" that CMA's capability to automatically acquire data on vessels of interest from multiple databases is faster than current data acquisition processes/systems. Forty-seven percent of users "strongly agreed," 32% "agreed," 16% were "n/a" and 5% of users "disagreed" that CMA's query capabilities (search and advanced search) save them considerable time in gathering information on a vessel of interest compared to current system capabilities. Fifty-three percent of users "strongly agreed" and 42% "agreed" that CMA's advanced search capability to filter information by location, time, vessel name, vessel attributes, etc., saves them time compared with having to do multiple individual searches.	usability of search	3	CMA	TW08
29	Technical Performance: Information Retrieval	Very little time was required for operators to access information from CMA, typically 1-10 min. This was with pre-selected ships where information was known to exist.	data & processing completeness, correctness, conflicts, timeliness	3	CMA	QRA
37	Technical Performance: Information Retrieval	Participants thought conducting analysis on a VOI was easier and much faster when using CMA than with their previous system.	speed	3	CMA	TW08
109	Technical Performance: Information Retrieval	Although the data reliability issue cited by users remains a concern, CMA is still a capable system and greatly enhances the warfighter's ability to maintain situational awareness.	operational utility for SA	3	CMA	QRA
144	Technical Performance: Information Retrieval	Most users agreed, or strongly agreed, CMA was easy to learn and use, as evidenced by the following: "With the exception of technological glitches that occasionally hindered CMA's performance I was able to learn and maneuver the program very quickly - it probably took less than two hours of training and a few examples to understand all the major features." Users were mixed about the helpfulness of the online help and about whether it was easy to use all the features included in CMA. (FAIRGAME)	usability re: learnability	3	CMA	EC EMIO

Item ID	Area	Item	Comments	Score	Technology	Venue
234	Technical Performance: Information Retrieval	Sixty-eight percent of users "strongly agreed" and 26% of users "agreed" that CMA's capability to correlate vessel, cargo, or people information automatically and store it in a single system makes my job easier and saves me time. Thirty-seven percent of users "strongly agreed," 37% of users "agreed," 21% of users indicated "N/A" and 5% of users "disagreed" that CMA's hypergraph display of vessel relationships with other vessels, crews, etc., is useful in rapidly identifying related information.	fusion of data	3	CMA	TRRLOE
236	Technical Performance: Information Retrieval	Sixty-three percent of users "agreed" and 34% of users "strongly agreed" that CMA's display of vessel attributes is useful in their analysis of vessels of interest. Sixty-three percent of users "agreed," 26% of users "strongly agreed," 16% of users were "N/A," and 5% of users "disagreed" that the quality of CMA automated track development functions supports their analysis tasks.	fusion of data	3	CMA	TW08
238	Technical Performance: Information Retrieval	Both CMA users strongly agreed it was easy to develop and maintain situation awareness on a vessel of interest (VOI), especially once provided with a watch list that includes the names of the vessels. CMA operators emphasized that it was extremely easy to find relevant information on a VOI as long as one knew the name of the vessel; otherwise it would be difficult due to the hyper graph.	operational utility for SA	3	CMA	TRRLOE
247	Technical Performance: Information Retrieval	Forty-two percent of users "agreed," 32% of users "strongly agreed," and 26% of users indicated "N/A" that their ability to individually identify and save analytic areas of interest in CMA helps them in their analytic work. Fifty-eight percent of users "strongly agreed" and 40% of users "agreed" that CMA's ability to display the track history of vessels is important to their analytic work.	features for search	3	CMA	TW08
249	Technical Performance: Information Retrieval	CMA - All four users, surveyed during FAIRGAME, agreed/ strongly agreed it was easy to search and track a VoI. Users were mixed regarding whether they were able to process and maintain situation awareness on more VoIs then with their previous system. (FAIRGAME)	operational utility for SA	3	CMA	VBSS
12	Technical Performance: Information Retrieval	CMA provided searchable data on vessel location, cargo, and people but there were gaps in track data, a lack of commonality of data between nodes, and insufficient information on data sources.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	QRA
16	Technical Performance: Information Retrieval	CMA: On several occasions a query of current vessel position returned multiple vessel positions, each with different metadata (time, cargo, flag) attached.	data & processing completeness, correctness, conflicts,	2	CMA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
			timeliness			
18	Technical Performance: Information Retrieval	Users noted a general inconsistency of the CMA vessel database between nodes within the same AOR. An analysis was performed on the commonality/consistency of track data held by the NAVCENT and PACFLT CMA systems within a 5 by 10 deg geographic region in the Indian Ocean. Although 97% of the tracks were held by both systems, significant track metadata differences were observed in 15% of the tracks, and track history data were only 51% common (77% common for tracks going from the NAVCENT AOR to the PACFLT AOR, and 29% common for tracks going in the other direction). Some track history data in one site's CMA were not in the other site's CMA.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	TRRLOE
20	Technical Performance: Information Retrieval	Users consistently cross referenced other data sources to validate query responses returned by CMA. The user had limited information on information feeds into CMA. The users' uncertainty in the completeness of the data affected confidence in the search results.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	TRRLOE
21	Technical Performance: Information Retrieval	The percentage of worldwide cargo data fed to CMA by Global Trader was not known. The percentage of worldwide cargo data available via Cargo Link was not known.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	QRA
26	Technical Performance: Information Retrieval	Users doubted the completeness of the CMA database and used other systems to validate the CMA search result. It is unclear to the user what data is actually feeding CMA; users noted the need for comparable data as available with the legacy systems.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	TRRLOE
27	Technical Performance: Information Retrieval	Users also noted that certain information is stripped from the Tripwire database before it reaches the user, but what is stripped is unknown.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	TRRLOE
31	Technical Performance: Information Retrieval	During FAIRGAME, users were mixed (responses ranged from disagree to agree) regarding whether they were able to develop awareness of VOIs faster with CMA "Again, definitely when there was a good fused picture or a complicated track I needed to follow. I imagine for most VOIs it won't be significantly faster, though." All users agreed/strongly agreed it was easy to find information on a VoI. (FAIRGAME)	operational utility for VOIs	2	CMA	VBSS
34	Technical Performance: Information Retrieval	Suggestions for Improvement and Useful Features. Both CMA users experienced difficulties using the alerting system as well as the hyper graph. Participants noted that when searching on CMA using a partial search, the system did not always pull up all tracks	usability	2	CMA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
		containing a portion of the name. One user recommended adding a feature to provide the capability to use range and bearing from a point in a circle to form a search area. This user also suggested including the ability to use a line or border to search for any track crossing a line rather than a box as is done in the current system.				
40	Technical Performance: Information Retrieval	CMA users suggested that the system should include a search pull down in the metadata section that allows for the search of cargo, making it easier to narrow down the hits.	features for search	2	CMA	TRRLOE
52	Technical Performance: Information Retrieval	CMA track data was primarily limited to tracks within the AOR. Lack of track data outside the AOR limited the user's ability to analyze maritime movement patterns.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	QRA
65	Technical Performance: Information Retrieval	CMA: Gaps in track and metadata also affected analysis of data within a node and affected the ability to collaborate between nodes.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	QRA
75	Technical Performance: Information Retrieval	CMA had a number of search capabilities that are easy to use. There are some deficiencies in advanced search, searching geographic areas, and partial-match performance. Specifics are listed in Appendix E, System Performance.	search	2	CMA	TRRLOE
123	Technical Performance: Information Retrieval	Comprehensive Maritime Awareness (CMA) -- The general consensus was CMA made it easier to do their job, but they did not agree that it made it faster. "Unless I had an extremely complicated task I'm not sure CMA would be faster than consulting individual intelligence sources, perhaps because I work quickly with computers and less complicated programs don't have the same technological glitches that sometimes thwarted CMA (such as losing the map feature - the "halo of death"). (FAIRGAME)	technology redundancy	2	CMA	VBSS
147	Technical Performance: Information Retrieval	The map is probably the most frustrating feature to use - for example you cannot draw a box and simultaneously use the ruler. Also, CMA runs significantly slower than some Baseline tools and occasionally the benefits of the fused intel is not worth the wait (that is, it didn't not provide significantly more information than looking on separate but faster baseline tools). Also some servers contained different information than others and that was frustrating and slowed me down."	usability of map	2	CMA	QRA
171	Technical Performance: Information Retrieval	CMA Alerts: Was unable to set up alerts and tripwires to notify of transit. Information on cargo and individuals on the vessel was limited.	data & processing completeness, correctness,	2	CMA	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
			conflicts, timeliness			
226	Technical Performance: Information Retrieval	Based on survey responses (n=19), CMA provides users with data that is relevant and helpful to their analysis of conditions of interest and CMA facilitated the reliable and timely analysis of maritime information. With regards to reliability, users reported that it is important to be able to view underlying data provided by CMA in evaluating tracks. Regarding timeliness, users reported that being able to access data from one source (CMA) was faster than existing procedures. Users also stated that it made their job easier to be able to correlate and store information in a single system. Finally, 63% of users strongly agreed that response time was adequate.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	TW08
228	Technical Performance: Information Retrieval	Sixty-three percent of users "strongly agreed" and 37% of users "agreed" the ability to view the underlying data that is used in CMA's track development is important to them in evaluating a track.	speed	2	CMA	TW08
230	Technical Performance: Information Retrieval	Sixty percent of users "strongly agreed" and 42% of users "agreed" that CMA's ability to automatically identify differences in a vessel's reported name, MMSI, IMO, SCONUM, call sign, emitter parametrics, cargo or crew assists them in their analysis.	operational utility for VOIs	2	CMA	TW08
14	Technical Performance: Information Retrieval	The user's ability to monitor vessel, person, and cargo data was severely degraded by gaps in track data coverage. When a node's CMA server was down, or data was not transmitted, the data not received was not recoverable. The Naval Research Laboratory (NRL) limited the National Technical Means (NTM) data source input to CMA to 14 hours per day and filtered the data that was provided. This resulted in a gap of data which had a negative impact across all AORs.	data & processing completeness, correctness, conflicts, timeliness	1	CMA	QRA
22	Technical Performance: Information Retrieval	The percentage of worldwide cargo data fed to CMA by Global Trader was not known. The percentage of worldwide cargo data available via Cargo Link was not known.	data & processing completeness, correctness, conflicts, timeliness	2	Global Trader	Workflow, PEW
23	Technical Performance: Information Retrieval	The user had no knowledge of foreign-to-foreign cargo sharing agreements or the amount of cargo data actually available, which affected the ability to build and evaluate cargo queries.	data & processing completeness, correctness, conflicts, timeliness	2	Global Trader	Workflow, PEW
118	Technical Performance: Information Retrieval	Usability. The operator felt that Google Earth was easy to learn, and use, finding no difficulty in using all of its features. The system was a quick geospatial reference for developing awareness on a VOI as well as finding information on them.	usabililty re: learnability	3	Google Earth	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
138	Technical Performance: Information Retrieval	Law Enforcement Information Exchange (LInX). LInX was rated by all observers as accessible, reliable, and usable. The ease of going back and forth between the Portal and LInX to exchange information from one system to another was noted. LInX was accessible via the FP Portal. Participants reported excellent ability to move between FP Portal and LInX. The information available through LInX was rated as moderate to high value, although one respondent wanted more depth of social linkage information. Respondents generally trusted the sources that provided information to LInX.	usability	3	LiNX	QRA
80	Technical Performance: Information Retrieval	Other than the collaboration tools, LINX was viewed as redundant and time consuming.	technology redundancy	2	LiNX	Workflow, PEW
96	Technical Performance: Information Retrieval	MASTER: Respondents agreed they could track vessels as needed. MASTER does a very good job of pulling vessel track history, provides named data that current systems do not, and facilitates vessel tracking with its graphical display and ability to compare tracks.	operational utility for VOIs	3	MASTER	TW08
215	Technical Performance: Information Retrieval	One user stated that MASTER completes tasks in 20 minutes that would take a GALE Lite user 10 hours because GALE Lite users have to manually stitch tracks.	speed	3	MASTER	TW08
9	Technical Performance: Information Retrieval	In MASTER, they differed on whether all the data sources needed to perform their tasks were available in MASTER. Sealink was suggested as a data source that could be integrated with MASTER.	data & processing completeness, correctness, conflicts, timeliness	2	MASTER	TRRLOE
43	Technical Performance: Information Retrieval	The MASTER archive database does not include cargo information; it contains only cold posits and associated data. Some users used Cargo Link instead of MASTER as a source of cargo information because they judged its database to be more extensive than MASTER's in this regard. Users indicated they need the ability to select individual cargo results and draw the tracks on the map in a manner similar to the track query select/draw function.	data & processing completeness, correctness, conflicts, timeliness	2	MASTER	TW08
62	Technical Performance: Information Retrieval	MASTER: MASTER provides a single source of tools which are superior to legacy, but users would prefer the two systems (MASTER and legacy) to interact. Users typically identified the correct tracks in their assigned scenarios, but various usability issues were observed Some users questioned the completeness or accuracy of the information in MASTER's database. Several users used SeaLink to find information on a port and to correlate old ship names with new ship names. One user utilized	usability	2	MASTER	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		the PMIC web page in attempting to determine the destination for a particular ship. Two users preferred ASA over MASTER because it is both faster and easier to use, not because it is more accurate than MASTER. Respondents agreed that they could count on the pre-defined alerts in MASTER to detect conditions of interest. Because alerts are not easy to set up using alert management and alert channels, one respondent recommended that alerts be based on completed searches and that an option be provided to save that search as an alert.				
94	Technical Performance: Information Retrieval	Respondents differed on whether MASTER reduced their workload compared to current methods. 11 of the 18 responses to this item agreed (4 strongly) that MASTER reduced their workload, but the other 7 responses disagreed. Comments supporting MASTER noted its analytical capabilities and ability to streamline multiple activities into one system, saving significant time. One respondent noted that MASTER reduced his workload by 25%, but would be even more effective if the ship's beneficiary country was included in the query info. Dissenting comments included: MASTER was not easily accessible; it cannot locate vessels in real time or find a first-time vessel with no history; its controls are awkward; and the computers were slow.	speed	2	MASTER	TRRLOE
99	Technical Performance: Information Retrieval	Criticisms noted that smaller vessels with SCONUMs are hard to detect, the archive database is slow, some data are not in real time, and a 48-hour history is sometimes insufficient.	data & processing completeness, correctness, conflicts, timeliness	2	MASTER	TW08
103	Technical Performance: Information Retrieval	MASTER: Respondents agreed MASTER is very useful for maritime analysis. The track analysis and plotting features are excellent tools, although the large amount of information MASTER provides may hamper a rapid analysis. Respondents also agreed MASTER's capability to integrate multi-source intelligence and information with fused SuperTrack data is valuable. It saves time, facilitates track fusion and analysis, and centralizes vessel data.	fusion of data	2	MASTER	TW08
106	Technical Performance: Information Retrieval	MASTER: Some users questioned the completeness or accuracy of the information in MASTER's database. Several users used SeaLink to find information on a port and to correlate old ship names with new ship names. One user utilized the PMIC web page in attempting to determine the destination for a particular ship. Two users preferred ASA over MASTER because it is both faster and easier to use, not because it is more accurate	data & processing completeness, correctness, conflicts, timeliness	2	MASTER	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		than MASTER. Respondents differed on whether MASTER processes multiple-source intelligence faster than current methods. 10 of the 21 responses to this item agreed that it did, but the other 11 disagreed. Criticism focused on MASTER's slowness, especially its slow query responses and map updates. Current tools (GALE, Sealink) were described as being much faster than MASTER. Another drawback is MASTER's current limit of one vessel per query.				
58	Technical Performance: Information Retrieval	Maritime Integrated Domain Awareness Solution (MIDAS). All three operators reported that MIDAS enhanced their ability to investigate concerns regarding VOIs or persons of interest and to understand why a vessel is suspicious / threatening. Two of the 3 said it enhanced their ability to display a user-defined picture of the operational environment, and that it provides access to relevant commercial and law enforcement data. All agreed that what is 'relevant data' in military operations is relative and changeable; 2 of 3 agreed that the MIDAS threat picture is able to be set to show relevance for a particular military situation. Operators generally agreed that they needed to have MDA at both classified and unclassified levels; 3 suggested that MIDAS would be best for UNCLAS data, and 2 others noted the need to integrate the unclassified data 'up' with the classified data. MIDAS data was mentioned as possibly complementing GCCS data for a fuller operational picture.	operational utility for VOIs	3	MIDAS	TW08
60	Technical Performance: Information Retrieval	MIDAS: All respondents agreed that MIDAS enables users to make adjustments to detection and assessment components to respond to changes in the military environment. Two respondents thought that MIDAS would enhance their ability to perform the following tasks, and one respondent was neutral: integrate and fuse relevant cross-type data from multiple sources and using cross-type data to identify anomalous or threatening behavior, in time to initiate an operational response. Two respondents thought that MIDAS would enhance their ability to use commercial and law enforcement databases to verify and analyze information returned by boarding parties, and one respondent was neutral. All three survey respondents thought the MIDAS would enhance their ability to drill down into data from multiple sources regarding potential threats.	fusion of data	3	MIDAS	QRA
135	Technical Performance: Information	PANDA: Most users were very satisfied or satisfied with the quality of information, in terms of its: availability (64%), completeness	data & processing completeness,	3	PANDA	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
	Retrieval	(74%), accuracy (78%), timeliness (71%), usefulness (78%), and relevance (71%) (percentages indicate percentage that were satisfied/ very satisfied).	correctness, conflicts, timeliness			
108	Technical Performance: Information Retrieval	PANDA: Most users indicated they would trust the information in PANDA to a great extent or moderate extent (86% total). One user indicated that the information was very "thorough" but other users indicated that they would trust the system more once they understood more about the sources or if known reliable sources were added.	data & processing completeness, correctness, conflicts, timeliness	2	PANDA	TW08
28	Technical Performance: Information Retrieval	Users also noted that certain information is stripped from the Tripwire database before it reaches the user, but what is stripped is unknown.	data & processing completeness, correctness, conflicts, timeliness	2	Tripwire	TRRLOE
51	Technical Performance: Information Sharing	Spiral-1 tools provided limited capability to fuse data across AORs and security classification domains. The user had a limited ability to view a composite track with all gathered information. The tools did not allow for user-defined pedigree rule sets.	fusion of data	2	All MDA Tech	TW08
66	Technical Performance: Information Sharing	Spiral-1 did not provide new toolsets to enhance collaboration between nodes. Spiral-1 technologies did allow for the easy export of search response data for use with existing collaborative tools. The collaboration tool of choice was MS Chat. NCIS used the web-based Force Protection Portal for cross AOR collaboration. The portal acted as a central repository for all information concerning the investigative scenarios.	features for collaboration	2	All MDA Tech	VBSS
125	Technical Performance: Information Sharing	Some users experienced situations when there was conflicting information when they collaborated with users on other systems. For example, one time the name of a vessel was completely different from the name listed in all other systems, even though other identifying features of the vessel matched. Also sometimes it doesn't pull in all the features from Cargolink/ Sealink that it could, which was frustrating. (FAIRGAME)	data & processing completeness, correctness, conflicts, timeliness	2	All MDA Tech	TW08
281	Technical Performance: Information Sharing	The NPS assessment team is concerned that effects of new information flow at higher volume may influence decision biases and processes in unexpected ways.	workload	2	All MDA Tech	Workflow PEW
285	Technical Performance: Information Sharing	The NPS assessment team is concerned that intelligence productivity using MDA technologies rise above operational capacity.	workload	2	All MDA Tech	Workflow PEW
76	Technical Performance: Information Sharing	There were significant differences in information available at different nodes.	data & processing completeness, correctness, conflicts,	1	All MDA Tech	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
			timeliness			
56	Technical Performance: Information Sharing	Forty-seven percent of users "agreed," 37% "strongly agreed," 11% "n/a," and 5% "disagreed" that sharing CMA data with other units and government agencies helped them to gather and share information on vessels of interest.	sharing data	3	CMA	TW08
54	Technical Performance: Information Sharing	MDA Spiral-1 was not a composite system and the ability to aggregate and replicate MDA data on a global scale was not possible. CMA did not replicate its database globally; each node maintained its own local database.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	n.a.
67	Technical Performance: Information Sharing	Degradation of communications capability was observed at one node due to bandwidth limitations while conducting multiple exercises. The node was required to timeshare bandwidth to accommodate each event. Communications capability should be considered if there are intentions to deploy these capabilities afloat or to a shore-based unit with limited capabilities.	system reliability	2	CMA	QRA
127	Technical Performance: Information Sharing	All users surveyed by NPS during FAIRGAME viewed CMA as an effective collaboration tool, although half had experienced conflicting information when they collaborated with other operators on a VoI. (FAIRGAME)	data & processing completeness, correctness, conflicts, timeliness	2	CMA	FAIRGAME
251	Technical Performance: Information Sharing	CMA - Users were mixed regarding whether it was easy to (1) collaborate on a VoI and (2) cross reference tracks being processed by operators using other systems. Users were mixed regarding how easy CMA made it for them to collaborate about the same information with users on other systems. (FAIRGAME) Yet, they all agreed it as easy to cross reference information on VoIs with operators using other systems.	features for collaboration	2	CMA	FAIRGAME
254	Technical Performance: Information Sharing	Fingerprints, iris images, and facial images were successfully captured and transmitted for analysis.	transmission of data	3	E-MIO Wireless	EC08 EMIO
255	Technical Performance: Information Sharing	Communications from a ship's interior was successful.	transmission of data	3	E-MIO Wireless	EC08 EMIO
256	Technical Performance: Information Sharing	Detain/don't detain messages were successfully communicated to the tactical units (communications were with test systems, not current operational systems).	transmission of data	3	E-MIO Wireless	EC08 EMIO
55	Technical Performance: Information Sharing	MDA Spiral-1 was not a composite system and the ability to aggregate and replicate MDA data on a global scale was not possible. CMA did not replicate its database globally, each node maintained its own local database.	data & processing completeness, correctness, conflicts, timeliness	2	Global Trader	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
232	Technical Performance: Information Sharing	Maritime Domain Awareness Data Sharing Community of Interest (MDA DS COI). All observers reported being able to access the MDA DS COI GMMS website. Also, all observers indicated the operator's information sharing attempts were seamless. However, one observer reported that although information was accessible, not all data were available in all geographic areas. Eighty percent of observers reported data was available when needed through MDA DS COI GMMS, however, comments indicated the Google Earth interface did not work and that the website was slow. Sixty-six percent of users agreed or strongly agreed that the MDS DS COI provided a single site for data producers and consumers to share unclassified MDA data. Regarding what was most liked, respondents mentioned ease of use and Google maps. Regarding what was least liked, respondents mentioned lack of usable data -- services up and down; errors received when requesting data, and inability to declutter or zoom on maps.	data & processing completeness, correctness, conflicts, timeliness	2	Google Earth	QRA
68	Technical Performance: Information Sharing	Google Earth has no embedded collaboration tool included, thus it was not possible to send information from Google Earth to other systems.	sharing data	1	Google Earth	TRRLOE
10	Technical Performance: Information Sharing	MASTER's strengths include its ability to support information sharing among users, receive intelligence from sources at the SECRET level and below, create watch areas and briefing materials, and define the operational picture to maintain awareness of the maritime environment.	misc	3	MASTER	TW08
233	Technical Performance: Information Sharing	Maritime Domain Awareness Data Sharing Community of Interest (MDA DS COI). All observers reported being able to access the MDA DS COI GMMS website. Also, all observers indicated that the operator's information sharing attempts were seamless. However, one observer reported that although information was accessible, not all data were available in all geographic areas. Eighty percent of observers reported data was available when needed through MDA DS COI GMMS, however, comments indicated that the Google Earth interface did not work and that the website was slow. Sixty-six percent of users agreed or strongly agreed that the MDS DS COI provided a single site for data producers and consumers to share unclassified MDA data. Regarding what was most liked, respondents mentioned ease of use and Google maps. Regarding what was least favorable, respondents mentioned lack of usable data -- services up and down; errors received when	data & processing completeness, correctness, conflicts, timeliness	2	MDA DS COI	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		requesting data, and inability to declutter or zoom on maps.				
293	Technical Performance: Information Sharing	MIDAS: Most respondents rated the following capability as important, sharing unclassified data with other agencies, militaries and non-traditional partners; making decisions about asset allocation to address potential threats; having a single User-Defined Operational Picture or access to MDA information.	policies for sharing data	2	MIDAS	TW08
44	Technical Performance: Information Sharing	PANDA: Regarding predicting deviation, most users (85%) responded that detecting deviation is a useful capability and all users responded that alerting for deviation is a useful capability. Most users responded that the capability of classifying alerts into categories (86%) and that PANDA's classification of alerts (86%) were useful. User responses were mixed about whether PANDA's explanation for the deviation was useful. Information that users would communicate to others about deviations included % likelihood a vessel would deviate, context information such as ship parts/spares/repair, and crew change/illness (currently not available in PANDA), other vessels in the area, whether a vessel maybe a potential threat or information for a task.	sharing data	3	PANDA	TW08
70	Technical Performance: Interoperability	Some CMA client workstations using legacy Internet Explorer 6 could not operate CMA. CMA is designed to operate on Internet Explorer 7. The workaround was to use the Firefox web browser.	interoperation with other systems	2	CMA	TW08
71	Technical Performance: Interoperability	CMA requires JAVA 1.6. Other host systems use legacy version JAVA 1.4. When CMA is loaded on the same hardware as GCCS-M, the JAVA 1.6 causes the local GCCS workstation to crash. The workaround is that CMA must be loaded on separate hardware.	interoperation with other systems	2	CMA	QRA
74	Technical Performance: Interoperability	Each node maintains its own CMA database with no two nodes having the same information.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	QRA
73	Technical Performance: Interoperability	User feedback indicated FASTC2AP on SIPRNET would be more useful/capable with additional GENSER track history feeds not available on CENTRIX.	data & processing completeness, correctness, conflicts, timeliness	2	FASTC2AP	TRRLOE
72	Technical Performance: Interoperability	When using CMA and Google Earth 4.2 simultaneously, system crashes resulted. Google Earth 4.2 had to be configured to use DIRECTX graphics setting instead of OpenGL graphics setting because the version of OpenGL installed on the CMA workstation	interoperation with other systems	2	Google Earth	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
		causes Google Earth to crash.				
140	Warfighter Acceptance: Human-System Interaction	Because MDA Spiral-1 was not a composite system, users were required to switch between windows and classification domains multiple times, causing them, at times, to become confused as to which domain they were looking at. The confusion caused users to lose track of the original security classification of the information they wished to disseminate.	integration of multiple displays	2	All MDA Tech	QRA
114	Warfighter Acceptance: Human-System Interaction	Usability. Both CMA operators thought the technology was easy to learn and use, Both CMA users strongly agreed it was easy to develop and maintain situation awareness on a vessel of interest (VOI),	usability	3	CMA	QRA
130	Warfighter Acceptance: Human-System Interaction	Users were able to easily create watch areas and do what they need to do for a mission. However, it should be noted that many users reported "N/A" with regard to ease of being able to create briefing materials and methods for creating watch areas.	usability of briefs	3	CMA	QRA
146	Warfighter Acceptance: Human-System Interaction	Most users agreed, or strongly agreed, CMA was easy to learn and use, as evidenced by the following: "With the exception of technological glitches that occasionally hindered CMA's performance I was able to learn and maneuver the program very quickly - it probably took less than two hours of training and a few examples to understand all the major features." Users were mixed about the helpfulness of the online help and about whether it was easy to use all the features included in CMA. (FAIRGAME)	usability of map	3	CMA	EC EMIO
155	Warfighter Acceptance: Human-System Interaction	CMA features they liked: (1) Nice search function, if a little slow; (2) Strongly agreed was able to process and maintain situation awareness on more than one VoI at a time more easily than with my previous system: "Especially with the "Map Viewer" and 'View Details" as separate windows - I love the tabbed browsing."	usability of search	3	CMA	VBSS
161	Warfighter Acceptance: Human-System Interaction	Watch areas: Very intuitive - I like that it saves them and they are easy to search in	usability of search	3	CMA	TW08
162	Warfighter Acceptance: Human-System Interaction	Bounding Box: Was able to mark and track areas w/ precision.	usability of map	3	CMA	VBSS
164	Warfighter Acceptance: Human-System Interaction	Name variants: Was able to limit searching. In addition was able to find specific vessels if I had specific information.	usability of search	3	CMA	VBSS
166	Warfighter Acceptance:	Tracking data: Was able to see the exact posits in the past and corroborate with the reporting	fusion of data	3	CMA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
	Human-System Interaction					
168	Warfighter Acceptance: Human-System Interaction	Associate data: This was the most helpful in that in addition to the ship information provided: Company name, location, master, crew and other information associated with the vessel. Again as a ct analyst want to look at more than just the vessel and where it is headed, want as much information as possible that associates the vessel with other entities.	fusion of data	3	CMA	VBSS
183	Warfighter Acceptance: Human-System Interaction	CMA: It was simply a matter of click on the vessel and most of the relevant information was placed before me. If I were a ship tracker this is great. In addition I would be able to use the additional information for the CT mission. I am not so much interested in the path of vessels but rather who/ what is on the vessel." (FAIRGAME)	fusion of data	3	CMA	VBSS
189	Warfighter Acceptance: Human-System Interaction	How the system applied to, or could be used for, the jobs with which they were familiar was clear.	operational utility	3	CMA	TRRLOE
192	Warfighter Acceptance: Human-System Interaction	Most users agreed, or strongly agreed, CMA was easy to use, and all agreed they were able to access and use the online help. (FAIRGAME)	usability of help	3	CMA	VBSS
240	Warfighter Acceptance: Human-System Interaction	It was easy for CMA users to associate tipper/ Intel information with the correct VOI. CMA showed recent alerts on the vessel and made it easy to see the tippers.	fusion of data	3	CMA	TRRLOE
35	Warfighter Acceptance: Human-System Interaction	Suggestions for Improvement and Useful Features. Both CMA users experienced difficulties using the alerting system as well as the hyper graph. Participants noted that when searching on CMA using a partial search, the system did not always pull up all tracks containing a portion of the name. One user recommended adding a feature to provide the capability to use range and bearing from a point in a circle to form a search area. This user also suggested including the ability to use a line or border to search for any track crossing a line rather than a box as is done in the current system.	usability of map and hypergraph	2	CMA	QRA
41	Warfighter Acceptance: Human-System Interaction	CMA users suggested that the system should include a search pull down in the metadata section that allows for the search of cargo, making it easier to narrow down the hits.	usability of menu	2	CMA	TRRLOE
141	Warfighter Acceptance: Human-System	CMA advance searches were not intuitive.	usability of search	2	CMA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
	Interaction					
142	Warfighter Acceptance: Human-System Interaction	Search capabilities in CMA and FASTC2AP are easy to use but there are a number of improvements that would improve their usability for operators and expand types of searches that can be undertaken. An appendix lists a number of improvements that operators have requested, listed under Human-System Interaction. Many suggestions have to do with constructing search areas and search parameters.	usability of search	2	CMA	TW08
148	Warfighter Acceptance: Human-System Interaction	The map is probably the most frustrating feature to use - for example you cannot draw a box and simultaneously use the ruler. Also, CMA runs significantly slower than some Baseline tools and occasionally the benefits of the fused intel is not worth the wait (that is, it didn't not provide significantly more information than looking on separate but faster baseline tools). Also some servers contained different information than others and that was frustrating and slowed me down."	fusion of data	2	CMA	TW08
149	Warfighter Acceptance: Human-System Interaction	To an extent it is helpful so see a fused picture of all the intel related to a specific vessel, but ONLY when this was available (sometimes there just isn't much more available on a vessel than what is in Sealink/SeaWatch) or when complicated scenarios demanded the use of CMA instead of a less advanced tracking system." (FAIRGAME)	usability	2	CMA	TRRLOE
151	Warfighter Acceptance: Human-System Interaction	Three of four users surveyed at FAIRGAME indicated there were feature they wanted to perform with the system that they did not understand. For example: "During the exercise there was a lot of confusion about being able to track vessels that come near a specific vessel at any time during its track - I still don't think this function is truly possible."	learnabilty	2	CMA	QRA
153	Warfighter Acceptance: Human-System Interaction	CMA: There were also actions they wanted to perform with the system that were not available, e.g., "I think the map could be more user-friendly - as I mentioned earlier one should be able to use the bounding box and then the ruler without using the box. Also, it would be helpful if there were a way to merge tracks that the system lists as separate hits due to slight discrepancies but are clearly the same vessel.	usability of map	2	CMA	VBSS
157	Warfighter Acceptance: Human-System Interaction	Other comments regarding human-system interaction for CMA: (1) Advanced search is tricky and not very intuitive but does the job; (2) the map could be more user-friendly - one should be able to use the bounding box and then the ruler without using the box; (3) it would be helpful if there was a way to merge tracks that the system lists as separate hits due to slight discrepancies but are clearly the same	usability of map	2	CMA	Workflow, PEW

Item ID	Area	Item	Comments	Score	Technology	Venue
		vessel. (FAIRGAME)				
159	Warfighter Acceptance: Human-System Interaction	View Details: Color-coded, fused intel was very helpful WHEN it was available. I would use CMA maybe after consulting one or two baseline programs first, otherwise it's sometimes just too impractical to poke around CMA when it is running slowly or having errors. However, if I have a specific set of variables for a VOI (i.e. past locations, people on board, flag, etc.) it is a very helpful resource.	usability of search	2	CMA	QRA
170	Warfighter Acceptance: Human-System Interaction	CMA Map: See above comments: also there are still some kinks that need to be worked out (possibly with Java) that made the program crash and I had to clear my Java files and restart the program - this happened much too often.	reliability	2	CMA	VBSS
172	Warfighter Acceptance: Human-System Interaction	CMA Alerts: Was unable to set up alerts and trip wires to notify of transit. Information on cargo and individuals on the vessel was limited.	usability of alerts	2	CMA	VBSS
245	Warfighter Acceptance: Human-System Interaction	CMA - All four users, surveyed during FAIRGAME, agreed/ strongly agreed it was easy to develop and maintain situation awareness on a VoI. Users were mixed (ranged from neutral to strongly agree) regarding whether it was easy to (1) find information on a VoI; (2) associate tipper/ intel information with the correct VoI; and (3) conduct analysis on a VoI. (FAIRGAME)	search	2	CMA	VBSS
179	Warfighter Acceptance: Human-System Interaction	Tactical EMIO System (TES) - Observations of the Maritime BGAN EMIO Terminal (MBET) demonstrated that (1) its design was very rugged and seemed to prevent water intrusion; and (2) the MBET device was not light enough to be carried on a VBSS person. The student user's felt that (1) the equipment should integrate the camera along with the biometric capability; (2) the Tactical EMIO Device (TED) had too many functions to organize the data; (3) they would prefer required less steps to configure the system; (4) the EMIO Gear was very mobile; and (5) the graphic user interface was intuitive and simple to use. (VBSS School)	usability	2	E-MIO Wireless	TRRLOE
225	Warfighter Acceptance: Human-System Interaction	Accordingly, the BFC manually entered into the CoT messages the position reported to them over VC1 chat.	integration of multiple tools	2	E-MIO Wireless	EC EMIO
116	Warfighter Acceptance: Human-System Interaction	Usability. The operator felt that FASTC2AP was difficult to learn resulting in the user having to try the agents multiple times in order to understand what each was providing in the way of results. The operator stated it was fairly easy to create agents; however	usability of agents	3	FASTC2AP	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
		understanding the results is difficult. It was easy to compose agents and to build alerts in order to fill RFIs, although the system could not provide the details required for some of the RFIs.				
78	Warfighter Acceptance: Human-System Interaction	A FASTC2AP geospatial option would allow greater situational awareness and agent building.	usability of map	2	FASTC2AP	QRA
143	Warfighter Acceptance: Human-System Interaction	Search capabilities in CMA and FASTC2AP are easy to use but there are a number of improvements that would improve their usability for operators and expand types of searches that can be undertaken. An appendix lists a number of improvements that operators have requested, listed under Human-System Interaction. Many suggestions have to do with constructing search areas and search parameters.	usability of search	2	FASTC2AP	TW08
177	Warfighter Acceptance: Human-System Interaction	FASTC2AP has predefined alert agents and the facility for operators to define their own alerts. The agents were useful but understanding some of the agent results was difficult. This was due to agent templates being difficult to understand. Setting up new agents is difficult. The system is non-intuitive.	usability of alerts	2	FASTC2AP	TRRLOE
119	Warfighter Acceptance: Human-System Interaction	Usability. The operator felt that Google Earth was easy to learn, and use, finding no difficulty in using all of its features. The system was a quick geospatial reference for developing awareness on a VOI as well as finding information on them.	usability of map	3	Google Earth	QRA
243	Warfighter Acceptance: Human-System Interaction	Conducting analysis on a VOI with Google Earth was easy, specifically for acquiring their last position; however the VOLPE AIS data was limited, and not useful for in-depth analysis or for providing tracking data.	data & processing completeness, correctness, conflicts, timeliness	3	Google Earth	TRRLOE
11	Warfighter Acceptance: Human-System Interaction	MASTER's user interface was judged to be clear, consistent, and easy to understand, and most respondents found it easy to get MASTER to do what they wanted, given adequate training and practice, which are needed to reach proficiency. Usability drawbacks include multiple click controls (2 or 3 clicks) for various features and slow response times, especially to database queries. MASTER's display also has a tendency to become too cluttered for effective viewing under higher traffic conditions.	usability re: clutter & efficiency	2	MASTER	n.a.
92	Warfighter Acceptance: Human-System Interaction	Its user interface could be improved by making the vessel of interest category more salient and improving the mapping program.	usability of map	2	MASTER	TRRLOE

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131	Warfighter Acceptance: Human-System Interaction	MASTER: Respondents agreed that MASTER is easy to use for creating tracks for vessels of interest, although one respondent noted that vessel tracks are archived too quickly to use for tracking VOIs. Recommended user interface improvements included: make the vessel of interest category more salient in current vessel details, improve the mapping program, and add the ability to take tracks from MASTER and transfer them into GALE to improve EIE tracking. One respondent wanted to be able to export track data to Excel to better compare tracks and to compile data more effectively.	usability	2	MASTER	TW08
175	Warfighter Acceptance: Human-System Interaction	Trip wire,/Alert: Simply unable to use. With more training am sure that too could be mastered	usability of alerts	2	MASTER	VBSS
136	Warfighter Acceptance: Human-System Interaction	Maritime Domain Awareness Data Sharing Community of Interest (MDA DS COI). Feedback indicates that usability was relatively low. Users were able to identify suspect VOIs, however, it was difficult. One observer stated "This user interface needs major improvement with respect to correlating data relationships between popup windows and the map, and the track data playback function. The process requires the operator to bounce between track data popup spreadsheets and layer tools lists. The operators had to manually document record track identifier numbers to compare data list on other windows. This process is prone to errors as demonstrated during this event."	integration of multiple displays	2	MDA DS COI	TW08
133	Warfighter Acceptance: Human-System Interaction	Predictive Analysis for Naval Deployment Activity (PANDA): Most users indicated that they information provided in PANDA was easy to understand. Eighty-six percent agreed (others were neutral) it was easy to understand the vessel list details; 93% agreed (1 user disagreed) the use of color associated with deviation types made sense; all users agreed it was easy to understand the meaning of the color coding; 86% agreed (others disagreed) that it was easy to understand the meaning of the labels used for deviation; 75% agreed (1 was neutral) PANDA made it apparent that a vessel's behavior was similar to previous behavior. Regarding normalcy: All users indicated that the PANDA was effective at representing the normal behaviors of vessels in the PANDA survey.	interpretability of output	3	PANDA	TRRLOE
185	Warfighter Acceptance: System Training	The post-installation training was generic in nature and not tailored to the individual site requirements/mission. User feedback indicated that the FAIRGAME scenario	customization of training	2	All MDA Tech	Workflow, PEW

Item ID	Area	Item	Comments	Score	Technology	Venue
		construct provided a more realistic training environment because the scenarios allowed for more real-world applications of the technologies. An official Navy training pipeline is not in place for MDA Spiral-1.				
279	Warfighter Acceptance: System Training	Operators were able to achieve reasonable competence on the systems after 3 hours of training and 2 hours of use on designed tactical problems. It is anticipated that a one week school on the full Spiral-1 suite would produce fully competent operators.	training speed	2	All MDA Tech	Workflow, PEW
287	Warfighter Acceptance: System Training	CINCPACFLEET is concerned about the feasibility of learning, using, and maintaining new MDA technologies given that it has a small intel unit.	staffing	2	All MDA Tech	Workflow, PEW
289	Warfighter Acceptance: System Training	ONI expresses concern about lack of lack of re-engineering of processes and training.	process re-engineering	2	All MDA Tech	TW08
291	Warfighter Acceptance: System Training	NAVCENT is concerned about training MDA technologies.	training	2	All MDA Tech	VBSS
292	Warfighter Acceptance: System Training	PACFLT and NAVCENT are concerned that COCOM-specific, mission-specific training be provided with MDA systems	customization of training	2	All MDA Tech	VBSS
145	Warfighter Acceptance: System Training	Most users agreed, or strongly agreed, CMA was easy to learn and use, as evidenced by the following: "With the exception of technological glitches that occasionally hindered CMA's performance I was able to learn and maneuver the program very quickly - it probably took less than two hours of training and a few examples to understand all the major features." Users were mixed about the helpfulness of the online help and about whether it was easy to use all the features included in CMA. (FAIRGAME)	training speed	3	CMA	EC EMIO
187	Warfighter Acceptance: System Training	CMA - Operator training on the operations they were asked to perform with the systems was minimal. Within this context, the following observations can be made:	training speed	3	CMA	TRRLOE
188	Warfighter Acceptance: System Training	They developed facility with the systems in a short period of time, usually after about ½ hour of working with functionality.	training speed	3	CMA	QRA
191	Warfighter Acceptance: System Training	It is clear that two or three days of focused training on the Spiral-1 suite will result in fully competent operators.	training speed	3	CMA	QRA
190	Warfighter Acceptance: System Training	There were instances where an operator searched for a function or capability CMA did not have. This could be a training issue and/or represent functionalities that should be added.	training completeness	2	CMA	QRA
213	Warfighter Acceptance:	CMA - Three of four users during FAIRGAME did not think t the alerting	training completeness	2	CMA	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
	System Training	system in CMA was easy to understand. ("I might not have been trained well enough on using it but I did not find the alerting system especially helpful, save for the ability to save watch areas which is an easy system.") Regarding whether the alerting system in CMA was useful and relevant, users were either neutral or disagreed, e.g., "To set up the trips was not easy. Establishing the bounding boxes and setting up the search parameters was easy but needed further instruction on alert set up." (FAIRGAME)				
297	Warfighter Acceptance: System Training	CMA - The envisioned CONOPS for future MDA will require training and familiarization with the new procedures as evidenced by the following: (1) "Have yet to truly collaborate with others, with the exception of perhaps shared watch areas;" and (2) "During the exercise there was a lot of confusion about being able to track vessels that come near a specific vessel at any time during its track - I still don't think this function is truly possible."	training availability	2	CMA	VBSS
300	Warfighter Acceptance: System Training	CMA - The envisioned TTP/SOP for future MDA will require training and familiarization with the new procedures as evidenced by the following: (1) "Have yet to truly collaborate with others, with the exception of perhaps shared watch areas;" and (2) "During the exercise there was a lot of confusion about being able to track vessels that come near a specific vessel at any time during its track - I still don't think this function is truly possible."	training availability	2	CMA	VBSS
186	Warfighter Acceptance: System Training	The Biometrics CM Jump Kit with MOBS V1.3.3 proved intuitive. The operator had 15 minutes of training. His time capturing a full enrollment decreased with each enrollment. By his third enrollment, he required no assistance.	training speed	3	E-MIO Wireless	VBSS
253	Warfighter Acceptance: System Training	The biometric Jump Kit required only a small amount of training to be used successfully.	training speed	3	E-MIO Wireless	VBSS
193	Warfighter Acceptance: System Training	Tactical EMIO System (TES) - Training for use of the Tactical EMIO System (TES) was conducted at the VBSS School in San Diego and testing was planned for two sessions at the conclusion of two courses (June and July). As is so often the case, the 10 student system users felt they did not receive enough training, and in particular, time to practice operating the system.	training completeness	2	E-MIO Wireless	VBSS
195	Warfighter Acceptance: System Training	Observing the operation of the Tactical EMIO Device (TED) in the field indicated the students would require additional training to fully operate the TED. However, the students were able to use the features to capture required data. Students asked many questions	training completeness	2	E-MIO Wireless	Workflow, PEW

Item ID	Area	Item	Comments	Score	Technology	Venue
		during the training which provided useful feedback to learn the perspective of the user. (VBSS School)				
277	Warfighter Acceptance: System Training	Tactical EMIO System (TES) - Students were not granted enough time to practice operating all three systems (TED, TEMP, and MBET). Observing the operation of the Tactical EMIO Device (TED) in the field indicated the students would require additional training to fully operate the TED.	training speed	2	E-MIO Wireless	VBSS
100	Warfighter Acceptance: System Training	Criticisms noted that smaller vessels with SCONUMS are hard to detect, the archive database is slow, some data are not in real time, a 48-hour history is sometimes insufficient,	data & processing completeness, correctness, conflicts, timeliness	2	MASTER	TW08
102	Warfighter Acceptance: System Training	there is a need for more training on Master	training	2	MASTER	QRA
205	Warfighter Acceptance: System Training	The MDA DS COI may provide a basic anomalous detection capability but since the users were not trained on the full capability it was not observed.	training completeness	2	MDA DS COI	TW08
89	Warfighter Acceptance: System Usage	Users were unaware of technology manuals and the Online Learning Development (OLLD). The draft online learning compact disc was made available to the nodes no earlier than two days before the start of FAIRGAME. The draft version of the OLLD is sufficient to provide the user with a baseline buttonology level of knowledge. The finalized version of the OLLD is expected to be made available via web services sometime in August 2008.	training in buttononlogy	3	All MDA Tech	QRA
88	Warfighter Acceptance: System Usage	Beyond the tasking provided by the White Cell, the users did not know why or when to use a specific technology to produce an expected results. Users required prompting by the White Cell, and observers, to think outside of the box when looking for specific information.	SOP and TTPs	2	All MDA Tech	QRA
181	Warfighter Acceptance: System Usage	During FAIRGAME, CMA was often the technology of choice when starting a search.	operational utility	3	CMA	QRA
182	Warfighter Acceptance: System Usage	The Tripwire system was the technology of choice for users who were experienced with the capabilities it provides.	operational utility	3	Tripwire	Workflow, PEW
2	Warfighter Acceptance: System Utility	The majority of users reported liking the ability that CMA gives them to leave an alert in a vessel file that can be used by other analysts. Users also reported being able to rely on pre-defined alerts to stay informed about vessels of interest. Regarding the timely attribute, users reported that query functions	search	3	CMA	EC EMIO

Item ID	Area	Item	Comments	Score	Technology	Venue
		saved significant time. Specifically, it was helpful to be able to filter by location, time, vessel name and vessel attributes.				
6	Warfighter Acceptance: System Utility	CMA is viewed as enhancing SA rapidly. Ninety percent of users either agreed or strongly agreed that they could maintain awareness of maritime activity through CMA. Forty-two percent of users "agreed," 26% "strongly agreed," 16% "disagreed," and 16% indicated "N/A" that CMA's capability to automatically acquire data on vessels of interest from multiple databases is faster than current data acquisition processes/systems. Forty-seven percent of users "strongly agreed," 32% "agreed," 16% were "n/a" and 5% of users "disagreed" that CMA's query capabilities (search and advanced search) save them considerable time in gathering information on a vessel of interest compared to current system capabilities. Fifty-three percent of users "strongly agreed" and 42% "agreed" that CMA's advanced search capability to filter information by location, time, vessel name, vessel attributes, etc., saves them time compared with having to do multiple individual searches.	search	3	CMA	TW08
30	Warfighter Acceptance: System Utility	Very little time was required for operators to access information from CMA, typically 1-10 min. This was with pre-selected ships where information was known to exist.	speed	3	CMA	QRA
38	Warfighter Acceptance: System Utility	Participants thought conducting analysis on a VOI was easier and much faster when using CMA than with their previous system.	speed	3	CMA	TW08
61	Warfighter Acceptance: System Utility	Forty-two percent of users "agreed," 32% "strongly agreed," and 26% indicated "N/A" that their ability to individually identify and save analytic areas of interest in CMA helps them in their analytic work.	speed	3	CMA	TW08
110	Warfighter Acceptance: System Utility	Although the data reliability issue cited by users remains a concern, CMA is still a capable system and greatly enhances the warfighter's ability to maintain situational awareness.	operational utility for SA	3	CMA	QRA
129	Warfighter Acceptance: System Utility	Ninety percent of users either agreed or strongly agreed that they could maintain awareness of maritime activity through CMA.	operational utility for SA	3	CMA	Workflow, PEW
32	Warfighter Acceptance: System Utility	During FAIRGAME, users were mixed (responses ranged from disagree to agree) regarding whether they were able to develop awareness of VOIs faster with CMA "Again, definitely when there was a good fused picture or a complicated track I needed to follow. I imagine for most VOIs it won't be significantly faster, though." All users agreed/strongly agreed it was easy to find	speed	2	CMA	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
		information on a VoI. (FAIRGAME)				
124	Warfighter Acceptance: System Utility	Comprehensive Maritime Awareness (CMA) -- The general consensus was CMA made it easier to do their job, but they did not agree that it made it faster. "Unless I had an extremely complicated task I'm not sure CMA would be faster than consulting individual intelligence sources, perhaps because I work quickly with computers and less complicated programs don't have the same technological glitches that sometimes thwarted CMA (such as losing the map feature - the "halo of death"). (FAIRGAME)	speed	2	CMA	VBSS
79	Warfighter Acceptance: System Utility	Google Earth fusion services provided some utility but was viewed as redundant.	technology redundancy	2	Google Earth	QRA
139	Warfighter Acceptance: System Utility	Law Enforcement Information Exchange (LInX). LInX was rated by all observers as accessible, reliable, and usable. The ease of going back and forth between the Portal and LInX to exchange information from one system to another was noted. LInX was accessible via the FP Portal. Participants reported excellent ability to move between FP Portal and LInX. The information available through LInX was rated as moderate to high value, although one respondent wanted more depth of social linkage information. Respondents generally trusted the sources that provided information to LInX.	usability	3	LiNX	TW08
81	Warfighter Acceptance: System Utility	Other than the collaboration tools, LINX was viewed as redundant and time consuming.	technology redundancy	2	LiNX	TRRLOE
294	Warfighter Acceptance: System Utility	Information from a stand-alone MAGNET system was not available due to sharing agreements concerning U.S. person's information.	data & processing completeness, correctness, conflicts, timeliness	2	MAGNET	n.a.
8	Warfighter Acceptance: System Utility	MASTER: Respondents agreed that they could maintain awareness of the maritime environment through the operational picture	operational utility for SA	3	MASTER	TW08
104	Warfighter Acceptance: System Utility	MASTER: Respondents agreed MASTER is very useful for maritime analysis. The track analysis and plotting features are excellent tools, although the large amount of information MASTER provides may hamper a rapid analysis. Respondents also agreed MASTER's capability to integrate multi-source intelligence and information with fused SuperTrack data is valuable. It saves time, facilitates track fusion and analysis, and centralizes vessel data.	fusion of data	2	MASTER	TW08
82	Warfighter	FAIRGAME user feedback indicated MDA	technology	2	MDA DS	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
	Acceptance: System Utility	DS COI has limited utility that might be accessed more as an afterthought or when all other systems had been exhausted.	redundancy		COI	
217	Warfighter Acceptance: System Utility	PANDA: All 12 users indicated PANDA would have a positive effect on their situation awareness. Users pointed to a variety of PANDA features that would support improved SA, including an increase in understanding of normalcy and anomalous vessel behavior, alerting to behavior that would otherwise be missed, prediction related to ships inbound to US ports, understanding of vessel history, and potential support for "proactive" analysis.	operational utility for SA	3	PANDA	VBSS
112	Warfighter Acceptance: System Utility	Tripwire Contextual information on vessels of interest and persons of interest is outstanding.	operational utility for VOIs	3	Tripwire	VBSS

6.1 Operations Performance Results

The assessment area "operations performance" concerns capabilities required to carry out specific operations: Vessel of Interest development and tracking; ISR planning, execution, and PED [define!]; and MIO planning, execution, and assessment. The key data concerning this assessment area are presented in **Table 14**.

Table 14. Operations Performance Results

Item ID	Area	Item	Comments	Score	Technology	Venue
50	Knowledge Processes: VoI Development	Spiral-1 tools increased the user's ability to fuse vessel, people, and cargo data from interagency sources	operational utility	3	All MDA Tech	QRA
260	Knowledge Processes: VoI Development	MIFCPAC will require MDA tools to discriminate between different types or activities of white vessels, e.g., US vs. foreign vessels in fisheries.	features	3	All MDA Tech	Workflow, PEW
48	Knowledge Processes: VoI Development	The lack of commonality between nodes made the aggregation of information difficult. MDA Spiral-1 did not contain a central repository of worldwide vessel movement data. Differences in node metadata required additional research on the part of the user, increasing the time required to perform a mission.	data & processing completeness, correctness, conflicts, timeliness	2	All MDA Tech	QRA
126	Knowledge Processes: VoI Development	Some users experienced situations when there was conflicting information when they collaborated with users on other systems. For example, one time the name of a vessel was completely different from the name listed in all other systems, even though other identifying features of the vessel matched. Also sometimes it doesn't pull in all the features from Cargolink/ Sealink that it could, which was frustrating. (FAIRGAME)	data & processing completeness, correctness, conflicts, timeliness	2	All MDA Tech	TW08
7	Knowledge Processes: VoI Development	CMA is viewed as enhancing SA rapidly. Ninety percent of users either agreed or strongly agreed that they could maintain awareness of maritime activity through CMA. Forty-two percent of users "agreed," 26% "strongly agreed," 16% "disagreed," and 16% indicated "N/A" that CMA's capability to automatically acquire data on vessels of interest from multiple databases is faster than current data acquisition	operational utility	3	CMA	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		processes/systems. Forty-seven percent of users "strongly agreed," 32% "agreed," 16% were "n/a" and 5% of users "disagreed" that CMA's query capabilities (search and advanced search) save them considerable time in gathering information on a vessel of interest compared to current system capabilities. Fifty-three percent of users "strongly agreed" and 42% "agreed" that CMA's advanced search capability to filter information by location, time, vessel name, vessel attributes, etc., saves them time compared with having to do multiple individual searches.				
39	Knowledge Processes: VoI Development	Participants thought conducting analysis on a VOI was easier and much faster when using CMA than with their previous system.	usability	3	CMA	TW08
57	Knowledge Processes: VoI Development	Forty-seven percent of users "agreed," 37% "strongly agreed," 11% "n/a," and 5% "disagreed" that sharing CMA data with other units and government agencies helped them to gather and share information on vessels of interest.	operational utility	3	CMA	TW08
115	Knowledge Processes: VoI Development	Usability. Both CMA operators thought the technology was easy to learn and use, Both CMA users strongly agreed it was easy to develop and maintain situation awareness on a vessel of interest (VOI),	usability	3	CMA	TRRLOE
156	Knowledge Processes: VoI Development	CMA features they liked: (1) Nice search function, if a little slow; (2) Strongly agreed was able to process and maintain situation awareness on more than one VoI at a time more easily than with my previous system: "Especially with the "Map Viewer" and 'View Details" as separate windows - I love the tabbed browsing."	operational utility	3	CMA	VBSS
165	Knowledge Processes: VoI Development	Name variants: Was able to limit searching. In addition was able to find specific vessels if I had specific information.	operational utility	3	CMA	n.a.
169	Knowledge Processes: VoI Development	Associate data: This was the most helpful in that in addition to the ship information provided: Company name, location, master, crew and other information associated with the vessel. Again as a ct analyst want to look at more than just the vessel and where it is headed, want as much	data & processing completeness, correctness, conflicts, timeliness	3	CMA	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
		information as possible that associates the vessel with other entities.				
184	Knowledge Processes: VoI Development	CMA: It was simply a matter of click on the vessel and most of the relevant information was placed before me. If I were a ship tracker this is great. In addition I would be able to use the additional information for the CT mission. I am not so much interested in the path of vessels but rather who/ what is on the vessel." (FAIRGAME)	usability	3	CMA	VBSS
198	Knowledge Processes: VoI Development	CMA: Thirty-seven percent of users "agreed," 32% indicated "N/A," 26% "strongly agreed," and 5% "strongly disagreed" they liked the ability CMA gives to leave an "alert" in a vessel file that can be used by other analysts. Forty-two percent of users indicated "N/A," 26% "agreed," 21% indicated "disagree," and 11% indicated "strongly agree" that they could count on the pre-defined alerts in CMA to detect conditions of interest and that CMA pre-defined alerts helped them stay informed about VoIs. Forty-two percent of users indicated "N/A," 32% "agreed," 11% "disagreed," and 16% strongly agreed CMA pre-defined alerts were understandable.	alerts	3	CMA	TW08
235	Knowledge Processes: VoI Development	Sixty-eight percent of users "strongly agreed" and 26% of users "agreed" that CMA's capability to correlate vessel, cargo, or people information automatically and store it in a single system makes my job easier and saves me time. Thirty-seven percent of users "strongly agreed," 37% of users "agreed," 21% of users indicated "N/A" and 5% of users "disagreed" that CMA's hypergraph display of vessel relationships with other vessels, crews, etc., is useful in rapidly identifying related information.	usability	3	CMA	Workflow, PEW
237	Knowledge Processes: VoI Development	Sixty-three percent of users "agreed" and 34% of users "strongly agreed" that CMA's display of vessel attributes is useful in their analysis of vessels of interest. Sixty-three percent of users "agreed," 26% of users "strongly agreed," 16% of users were "N/A," and 5% of users "disagreed" that the quality of CMA automated track development	operational utility	3	CMA	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		functions supports their analysis tasks.				
239	Knowledge Processes: VoI Development	Both CMA users strongly agreed it was easy to develop and maintain situation awareness on a vessel of interest (VOI), especially once provided with a watch list that includes the names of the vessels. CMA operators emphasized that it was extremely easy to find relevant information on a VOI as long as one knew the name of the vessel; otherwise it would be difficult due to the hyper graph.	operational utility	3	CMA	TRRLOE
242	Knowledge Processes: VoI Development	It was easy for CMA users to associate tipper/ Intel information with the correct VOI. CMA showed recent alerts on the vessel and made it easy to see the tippers.	usability	3	CMA	TRRLOE
248	Knowledge Processes: VoI Development	Forty-two percent of users "agreed," 32% of users "strongly agreed," and 26% of users indicated "N/A" that their ability to individually identify and save analytic areas of interest in CMA helps them in their analytic work. Fifty-eight percent of users "strongly agreed" and 40% of users "agreed" that CMA's ability to display the track history of vessels is important to their analytic work.	operational utility	3	CMA	TW08
250	Knowledge Processes: VoI Development	CMA - All four users, surveyed during FAIRGAME, agreed/ strongly agreed it was easy to search and track a VoI. Users were mixed regarding whether they were able to process and maintain situation awareness on more VoIs then with their previous system. (FAIRGAME)	usability	3	CMA	VBSS
33	Knowledge Processes: VoI Development	During FAIRGAME, users were mixed (responses ranged from disagree to agree) regarding whether they were able to develop awareness of VOIs faster with CMA "Again, definitely when there was a good fused picture or a complicated track I needed to follow. I imagine for most VOIs it won't be significantly faster, though." All users agreed/strongly agreed it was easy to find information on a VoI. (FAIRGAME)	usability	2	CMA	VBSS
42	Knowledge Processes: VoI Development	CMA users suggested that the system should include a search pull down in the metadata section that allows for the search of cargo, making it easier to narrow down the hits.	features	2	CMA	TRRLOE

Item ID	Area	Item	Comments	Score	Technology	Venue
128	Knowledge Processes: VoI Development	All users surveyed by NPS during FAIRGAME viewed CMA as an effective collaboration tool, although half had experienced conflicting information when they collaborated with other operators on a VoI. (FAIRGAME)	data & processing completeness, correctness, conflicts, timeliness	2	CMA	VBSS
150	Knowledge Processes: VoI Development	To an extent it is helpful so see a fused picture of all the intel related to a specific vessel, but ONLY when this was available (sometimes there just isn't much more available on a vessel than what is in Sealink/SeaWatch) or when complicated scenarios demanded the use of CMA instead of a less advanced tracking system." (FAIRGAME)	data & processing completeness, correctness, conflicts, timeliness	2	CMA	EC EMIO
152	Knowledge Processes: VoI Development	Three of four users surveyed at FAIRGAME indicated there were feature they wanted to perform with the system that they did not understand. For example: "During the exercise there was a lot of confusion about being able to track vessels that come near a specific vessel at any time during its track - I still don't think this function is truly possible."	usability	2	CMA	TW08
154	Knowledge Processes: VoI Development	CMA: There were also actions they wanted to perform with the system that were not available, e.g., "I think the map could be more user-friendly - as I mentioned earlier one should be able to use the bounding box and then the ruler without using the box. Also, it would be helpful if there was a way to merge tracks that the system lists as separate hits due to slight discrepancies but are clearly the same vessel.	features	2	CMA	VBSS
158	Knowledge Processes: VoI Development	Other comments regarding human-system interaction for CMA: (1) Advanced search is tricky and not very intuitive but does the job; (2) the map could be more user-friendly - one should be able to use the bounding box and then the ruler without using the box; (3) it would be helpful if there was a way to merge tracks that the system lists as separate hits due to slight discrepancies but are clearly the same vessel. (FAIRGAME)	usability	2	CMA	Workflow, PEW
160	Knowledge Processes: VoI	View Details: Color-coded, fused intel was very helpful WHEN it was available. I would use CMA maybe	data & processing completeness,	2	CMA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
	Development	after consulting one or two baseline programs first, otherwise it's sometimes just too impractical to poke around CMA when it is running slowly or having errors. However, if I have a specific set of variables for a VOI (i.e. past locations, people on board, flag, etc.) it is a very helpful resource.	correctness, conflicts, timeliness			
174	Knowledge Processes: VoI Development	CMA Alerts: Was unable to set up alerts and trip wires to notify of transit. Information on cargo and individuals on the vessel was limited.	alerts	2	CMA	VBSS
229	Knowledge Processes: VoI Development	Sixty-three percent of users "strongly agreed" and 37% of users "agreed" the ability to view the underlying data that is used in CMA's track development is important to them in evaluating a track.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	TW08
231	Knowledge Processes: VoI Development	Sixty percent of users "strongly agreed" and 42% of users "agreed" that CMA's ability to automatically identify differences in a vessel's reported name, MMSI, IMO, SCONUM, call sign, emitter parametrics, cargo or crew assists them in their analysis.	operational utility	2	CMA	TRRLOE
246	Knowledge Processes: VoI Development	CMA - All four users, surveyed during FAIRGAME, agreed/ strongly agreed it was easy to develop and maintain situation awareness on a VoI. Users were mixed (ranged from neutral to strongly agree) regarding whether it was easy to (1) find information on a VoI; (2) associate tipper/ intel information with the correct VoI; and (3) conduct analysis on a VoI. (FAIRGAME)	operational utility	2	CMA	VBSS
252	Knowledge Processes: VoI Development	CMA - Users were mixed regarding whether it was easy to (1) collaborate on a VoI and (2) cross reference tracks being processed by operators using other systems. Users were mixed regarding how easy CMA made it for them to collaborate about the same information with users on other systems. (FAIRGAME) Yet, they all agreed it as easy to cross reference information on VoIs with operators using other systems.	usability	2	CMA	VBSS
298	Knowledge Processes: VoI Development	CMA - The envisioned CONOPS for future MDA will require training and familiarization with the new procedures as evidenced by the following: (1) "Have yet to truly	training	2	CMA	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
		collaborate with others, with the exception of perhaps shared watch areas;" and (2) "During the exercise there was a lot of confusion about being able to track vessels that come near a specific vessel at any time during its track - I still don't think this function is truly possible."				
301	Knowledge Processes: VoI Development	CMA - The envisioned TTP/SOP for future MDA will require training and familiarization with the new procedures as evidenced by the following: (1) "Have yet to truly collaborate with others, with the exception of perhaps shared watch areas;" and (2) "During the exercise there was a lot of confusion about being able to track vessels that come near a specific vessel at any time during its track - I still don't think this function is truly possible."	training	2	CMA	VBSS
85	Knowledge Processes: VoI Development	Tactical EMIO System (TES) - While mobility of the Tactical EMIO Device (TED) was a clear advantage, enabling the collection of data from multiple locations within the vessel, one limitation noted was that the TED must be within the vicinity of the Tactical EMIO Maritime PC (TEMP) to download the data captured. Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not strong enough to transmit data when team members were below decks. The Maritime BGAN EMIO Terminal (MBET) device, in turn, failed to transfer data due to environmental issues and weak RF Signal range of the commercial satellite. Contractors eventually departed the target vessel and drove inland with the TEMP and MBET device to acquire a stronger signal. The MBET link was then acquired and successfully transmitted data from the TEMP device. Contractors asserted that the satellite connectivity will not be a concern in the current AOR. Also, the boarding officer was not able to demonstrate the transfer of data via the Maritime BGAN EMIO Terminal (MBET) due to the satellite connectivity. (VBSS School)	connectivity	1	E-MIO Wireless	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
24	Knowledge Processes: VoI Development	The user had no knowledge of foreign-to-foreign cargo sharing agreements or the amount of cargo data actually available, which affected the ability to build and evaluate cargo queries.	data & processing completeness, correctness, conflicts, timeliness	2	Global Trader	QRA
120	Knowledge Processes: VoI Development	Usability. The operator felt that Google Earth was easy to learn, and use, finding no difficulty in using all of its features. The system was a quick geospatial reference for developing awareness on a VOI as well as finding information on them.	usability	3	Google Earth	QRA
244	Knowledge Processes: VoI Development	Conducting analysis on a VOI with Google Earth was easy, specifically for acquiring their last position; however the VOLPE AIS data was limited, and not useful for in-depth analysis or for providing tracking data.	usability	3	Google Earth	TRRLOE
91	Knowledge Processes: VoI Development	Respondents mostly agreed that MASTER's capability to automatically acquire data on vessels of interest is superior to current data acquisition processes. MASTER's track analysis and graphing capabilities were among its strengths, but its archive database was often slow to respond to queries. MASTER was easy to use when creating new vessel tracks.	operational utility	3	MASTER	TW08
93	Knowledge Processes: VoI Development	Its user interface could be improved by making the vessel of interest category more salient and improving the mapping program.	usability	2	MASTER	TW08
95	Knowledge Processes: VoI Development	Respondents differed on whether MASTER reduced their workload compared to current methods. 11 of the 18 responses to this item agreed (4 strongly) that MASTER reduced their workload, but the other 7 responses disagreed. Comments supporting MASTER noted its analytical capabilities and ability to streamline multiple activities into one system, saving significant time. One respondent noted that MASTER reduced his workload by 25%, but would be even more effective if the ship's beneficiary country was included in the query info. Dissenting comments included: MASTER was not easily accessible; it cannot locate vessels in real time or find a first-time vessel with no history; its controls are awkward; and the computers were slow.	usability	2	MASTER	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
101	Knowledge Processes: VoI Development	Criticisms noted that smaller vessels with SCONUMS are hard to detect, the archive database is slow, some data are not in real time, a 48-hour history is sometimes insufficient,	data & processing completeness, correctness, conflicts, timeliness	2	MASTER	TW08
105	Knowledge Processes: VoI Development	MASTER: Respondents agreed MASTER is very useful for maritime analysis. The track analysis and plotting features are excellent tools, although the large amount of information MASTER provides may hamper a rapid analysis. Respondents also agreed MASTER's capability to integrate multi-source intelligence and information with fused SuperTrack data is valuable. It saves time, facilitates track fusion and analysis, and centralizes vessel data.	operational utility	2	MASTER	TW08
107	Knowledge Processes: VoI Development	MASTER: Some users questioned the completeness or accuracy of the information in MASTER's database. Several users used SeaLink to find information on a port and to correlate old ship names with new ship names. One user utilized the PMIC web page in attempting to determine the destination for a particular ship. Two users preferred ASA over MASTER because it is both faster and easier to use, not because it is more accurate than MASTER. Respondents differed on whether MASTER processes multiple-source intelligence faster than current methods. 10 of the 21 responses to this item agreed that it did, but the other 11 disagreed. Criticism focused on MASTER's slowness, especially its slow query responses and map updates. Current tools (GALE, Sealink) were described as being much faster than MASTER. Another drawback is MASTER's current limit of one vessel per query.	data & processing completeness, correctness, conflicts, timeliness	2	MASTER	TW08
132	Knowledge Processes: VoI Development	MASTER: Respondents agreed that MASTER is easy to use for creating tracks for vessels of interest, although one respondent noted that vessel tracks are archived too quickly to use for tracking VOIs. Recommended user interface improvements included: make the vessel of interest category more salient in current vessel details,	usability	2	MASTER	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		improve the mapping program, and add the ability to take tracks from MASTER and transfer them into GALE to improve EIE tracking. One respondent wanted to be able to export track data to Excel to better compare tracks and to compile data more effectively.				
137	Knowledge Processes: VoI Development	Maritime Domain Awareness Data Sharing Community of Interest (MDA DS COI). Feedback indicates that usability was relatively low. Users were able to identify suspect VOIs, however, it was difficult. One observer stated "This user interface needs major improvement with respect to correlating data relationships between popup windows and the map, and the track data playback function. The process requires the operator to bounce between track data popup spreadsheets and layer tools lists. The operators had to manually document record track identifier numbers to compare data list on other windows. This process is prone to errors as demonstrated during this event."	usability	2	MDA DS COI	TW08
59	Knowledge Processes: VoI Development	Maritime Integrated Domain Awareness Solution (MIDAS). -All three operators reported that MIDAS enhanced their ability to investigate concerns regarding VOIs or persons of interest and to understand why a vessel is suspicious / threatening. Two of the 3 said it enhanced their ability to display a user-defined picture of the operational environment, and that it provides access to relevant commercial and law enforcement data. All agreed that what is 'relevant data' in military operations is relative and changeable; 2 of 3 agreed that MIDAS threat picture is able to be set to show relevance for a particular military situation. Operators generally agreed that they needed to have MDA at both classified and unclassified levels; 3 suggested that MIDAS would be best for UNCLAS data, and 2 others noted the need to integrate the unclassified data 'up' with the classified data. MIDAS data was mentioned as possibly complementing GCCS data for a fuller operational picture.	operational utility	3	MIDAS	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
46	Knowledge Processes: VoI Development	PANDA: Regarding predicting deviation, most users (85%) responded that detecting deviation is a useful capability and all users responded that alerting for deviation is a useful capability. Most users responded that the capability of classifying alerts into categories (86%) and that PANDA's classification of alerts (86%) were useful. User responses were mixed about whether PANDA's explanation for the deviation was useful. Information that users would communicate to others about deviations included % likelihood a vessel would deviate, context information such as ship parts/spares/repair, and crew change/illness (currently not available in PANDA), other vessels in the area, whether a vessel maybe a potential threat or information for a task.	alerts	3	PANDA	TW08
134	Knowledge Processes: VoI Development	Predictive Analysis for Naval Deployment Activity (PANDA): Most users indicated that they information provided in PANDA was easy to understand. Eighty-six percent agreed (others were neutral) it was easy to understand the vessel list details; 93% agreed (1 user disagreed) the use of color associated with deviation types made sense; all users agreed it was easy to understand the meaning of the color coding; 86% agreed (others disagreed) that it was easy to understand the meaning of the labels used for deviation; 75% agreed (1 was neutral) PANDA made it apparent that a vessel's behavior was similar to previous behavior. Regarding normalcy: All users indicated that the PANDA was effective at representing the normal behaviors of vessels in the PANDA survey.	usability	3	PANDA	TRRLOE
202	Knowledge Processes: VoI Development	PANDA: Regarding deviation: All users responded that PANDA was effective at alerting for deviations and that PANDA's explanation for the deviation was reasonable and made sense. Most users indicated that it was easy to understand the explanation for the deviation (67% and 83% strongly agreed; others were neutral). Regarding prediction:	alerts	3	PANDA	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		Sixty-seven percent of users (67%) responded that PANDA was effective at representing predicted vessel behavior (others were neutral and disagreed).				
219	Knowledge Processes: VoI Development	PANDA: All 12 users indicated PANDA would have a positive effect on their situation awareness. Users pointed to a variety of PANDA features that would support improved SA, including an increase in understanding of normalcy and anomalous vessel behavior, alerting to behavior that would otherwise be missed, prediction related to ships inbound to US ports, understanding of vessel history, and potential support for "proactive" analysis.	operational utility	3	PANDA	QRA
113	Knowledge Processes: VoI Development	Tripwire Contextual information on vessels of interest and persons of interest is outstanding.	data & processing completeness, correctness, conflicts, timeliness	3	Tripwire	VBSS
4	Knowledge Processes: VoI Tracking	The majority of users reported liking the ability that CMA gives them to leave an alert in a vessel file that can be used by other analysts. Users also reported being able to rely on pre-defined alerts to stay informed about vessels of interest. Regarding the timely attribute, users reported that query functions saved significant time. Specifically, it was helpful to be able to filter by location, time, vessel name and vessel attributes.	alerts	3	CMA	QRA
163	Knowledge Processes: VoI Tracking	Bounding Box: Was able to mark and track areas w/ precision____	usability	3	CMA	VBSS
167	Knowledge Processes: VoI Tracking	Tracking data: Was able to see the exact posits in the past and corroborate with the reporting	misc	3	CMA	TRRLOE
13	Knowledge Processes: VoI Tracking	CMA provided searchable data on vessel location, cargo, and people but there were gaps in track data, a lack of commonality of data between nodes, and insufficient information on data sources.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	QRA
17	Knowledge Processes: VoI Tracking	CMA: On several occasions a query of current vessel position returned multiple vessel positions, each with different metadata (time, cargo, and flag) attached.	data & processing completeness, correctness, conflicts, timeliness	2	CMA	QRA
19	Knowledge Processes: VoI Tracking	Users noted a general inconsistency of the CMA vessel database between nodes within the same AOR. An	data & processing completeness,	2	CMA	QRA

Item ID	Area	Item	Comments	Score	Technology	Venue
		analysis was performed on the commonality/consistency of track data held by the NAVCENT and PACFLT CMA systems within a 5 by 10 deg geographic region in the Indian Ocean. Although 97% of the tracks were held by both systems, significant track metadata differences were observed in 15% of the tracks, and track history data were only 51% common (77% common for tracks going from the NAVCENT AOR to the PACFLT AOR, and 29% common for tracks going in the other direction). Some track history data in one site's CMA were not in the other site's CMA.	correctness, conflicts, timeliness			
227	Knowledge Processes: VoI Tracking	Based on survey responses (n=19), CMA provides users with data that is relevant and helpful to their analysis of conditions of interest and CMA facilitated the reliable and timely analysis of maritime information. With regards to reliability, users reported that it is important to be able to view underlying data provided by CMA in evaluating tracks. Regarding timeliness, users reported that being able to access data from one source (CMA) was faster than existing procedures. Users also stated that it made their job easier to be able to correlate and store information in a single system. Finally, 63% of users strongly agreed that response time was adequate.	usability	2	CMA	TW08
15	Knowledge Processes: VoI Tracking	The user's ability to monitor vessel, person, and cargo data was severely degraded by gaps in track data coverage. When a node's CMA server was down, or data was not transmitted, the data not received was not recoverable. The Naval Research Laboratory (NRL) limited the National Technical Means (NTM) data source input to CMA to 14 hours per day and filtered the data that was provided. This resulted in a gap of data which had a negative impact across all AORs.	data & processing completeness, correctness, conflicts, timeliness	1	CMA	QRA
98	Knowledge Processes: VoI Tracking	MASTER: Respondents agreed they could track vessels as needed. MASTER does a very good job of pulling vessel track history, provides named data that current systems do not, and facilitates vessel tracking	operational utility	3	MASTER	TW08

Item ID	Area	Item	Comments	Score	Technology	Venue
		with its graphical display and ability to compare tracks.				
216	Knowledge Processes: VoI Tracking	One user stated that MASTER completes tasks in 20 minutes that would take a GALE Lite user 10 hours because GALE Lite users have to manually stitch tracks.	speed	3	MASTER	Workflow, PEW
258	MIO: Execution	MIO situation awareness was maintained at rear units.	operational utility	3	E-MIO Wireless	EC EMIO
180	MIO: Execution	Tactical EMIO System (TES) - Observations of the Maritime BGAN EMIO Terminal (MBET) demonstrated that (1) its design was very rugged and seemed to prevent water intrusion; and (2) the MBET device was not light enough to be carried on a VBSS person. The student user's felt that (1) the equipment should integrate the camera along with the biometric capability; (2) the Tactical EMIO Device (TED) had too many functions to organize the data; (3) they would prefer required less steps to configure the system; (4) the EMIO Gear was very mobile; and (5) the graphic user interface was intuitive and simple to use. (VBSS School)	usability	2	E-MIO Wireless	TRRLOE
194	MIO: Execution	Tactical EMIO System (TES) - Training for use of the Tactical EMIO System (TES) was conducted at the VBSS School in San Diego and testing was planned for two sessions at the conclusion of two courses (June and July). As is so often the case, the 10 student system users felt they did not receive enough training, and in particular, time to practice operating the system.	training	2	E-MIO Wireless	VBSS
196	MIO: Execution	Observing the operation of the Tactical EMIO Device (TED) in the field indicated the students would require additional training to fully operate the TED. However, the students were able to use the features to capture required data. Students asked many questions during the training which provided useful feedback to learn the perspective of the user. (VBSS School)	training	2	E-MIO Wireless	Workflow, PEW
278	MIO: Execution	Tactical EMIO System (TES) - Students were not granted enough time to practice operating all three systems (TED, TEMP, and MBET). Observing the operation of the	training	2	E-MIO Wireless	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
		Tactical EMIO Device (TED) in the field indicated the students would require additional training to fully operate the TED.				
86	MIO: Execution	Tactical EMIO System (TES) - While mobility of the Tactical EMIO Device (TED) was a clear advantage, enabling the collection of data from multiple locations within the vessel, one limitation noted was that the TED must be within the vicinity of the Tactical EMIO Maritime PC (TEMP) to download the data captured. Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not strong enough to transmit data when team members were below decks. The Maritime BGAN EMIO Terminal (MBET) device, in turn, failed to transfer data due to environmental issues and weak RF Signal range of the commercial satellite. Contractors eventually departed the target vessel and drove inland with the TEMP and MBET device to acquire a stronger signal. The MBET link was then acquired and successfully transmitted data from the TEMP device. Contractors asserted that the satellite connectivity will not be a concern in the current AOR. Also, the boarding officer was not able to demonstrate the transfer of data via the Maritime BGAN EMIO Terminal (MBET) due to the satellite connectivity. (VBSS School)	connectivity	1	E-MIO Wireless	VBSS
122	MIO: Execution	Tactical EMIO System (TES) - Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The radio frequency (RF) signals were not storing enough to transmit data when team members were below decks. (VBSS School)	connectivity	1	E-MIO Wireless	TRRLOE
224	MIO: Execution	There were no positions provided with the latent print messages and for the cave collection, there was no SeekID Global Positioning System (GPS) reception and therefore no position was included in the biometric messages.	features	1	E-MIO Wireless	QRA

6.2 Warfighter Performance Results

The assessment area "warfighter performance" addresses the capability of warfighters to conduct MDA missions.

No findings bore directly on this assessment area.

6.3 Organization/Guidance Results

The assessment area "organization/guidance" concerns the alignment of organizations to MDA missions, the alignment of MDA processes or tasks with those specified in the MHQ with MOC process architecture ([Jared: citation]), the alignment of international and inter-organization agreements with MDA mission requirements, and the availability of CONOPS, TTPs, SOP, and standing orders for MDA missions. The key data concerning this assessment area are presented in **Table 15**.

Table 15. Organization/Guidance Results

Item ID	Area	Item	Comments	Score	Technology	Venue
295	Agreements: Information Sharing	Information from a stand-alone MAGNET system was not available due to sharing agreements concerning U.S. person's information.	constraints imposed by policies and agreements	2	MAGNET	QRA
296	Agreements: Information Sharing	MIDAS: Respondents acknowledged that there is currently a need to collaborate with other agencies, coalition members and non-traditional partners, and most felt that MIDAS would help to facilitate that collaboration; however, 2 mentioned that sharing sensitive or classified information might be a problem.	constraints imposed by policies and agreements	2	MIDAS	TW08
299	Guidance: CONOPS	CMA - The envisioned CONOPS for future MDA will require training and familiarization with the new procedures as evidenced by the following: (1) "Have yet to truly collaborate with others, with the exception of perhaps shared watch areas;" and (2) "During the exercise there was a lot of confusion about being able to track vessels that come near a specific vessel at any time during its track - I still don't think this function is truly possible."	training for CONOPS	2	CMA	VBSS
302	Guidance: TTP/SOP	CMA - The envisioned TTP/SOP for future MDA will require training and familiarization with the	training for TTP	2	CMA	VBSS

Item ID	Area	Item	Comments	Score	Technology	Venue
		new procedures as evidenced by the following: (1) "Have yet to truly collaborate with others, with the exception of perhaps shared watch areas;" and (2) "During the exercise there was a lot of confusion about being able to track vessels that come near a specific vessel at any time during its track - I still don't think this function is truly possible."				
290	MDA Compatibility: Organization Alignment	ONI expresses concern about lack of lack of re-engineering of processes and training.	coordination of MDA and ONI processes	2	All MDA Tech	TW08
304	MDA Compatibility: Organization Alignment	ONI is conducting process analyses concerning intel analysis. It is not clear that this effort is synchronized with the MDA technology effort.	coordination of MDA with ONI processes	2	All MDA Tech	Workflow, PEW
276	MHQ/MOC Compatibility: Organization Alignment	The NPS assessment team is concerned that MDA TTPs need to be sufficiently flexible to accommodate differences between COCOMS.	customization to local needs	2	All MDA Tech	TW08
303	MHQ/MOC Compatibility: Process Alignment	Second Fleet, NAVNETWARCOM, and others concur that the MDA workflow aligns with the MHQ w/MOC process architecture as of early 2008. (See Process Alignment Workshop).	alignment of MDA and MHQ w/MOC processes	3	All MDA Tech	TW08

6.4 System Supportability and Readiness

The assessment area "System Supportability and Readiness" concerns operations and maintenance required to ensure the readiness of forces using Spiral-1 systems. This assessment is made by PEO C4I. However, several data points bore on these general concerns (see **Table 16**). Findings specific to training are presented in assessment area 5.3.4: Warfighter Acceptance: System Training.

Table 16. System Supportability and Readiness Results

Item ID	Area	Item	Comments	Score	Technology	Venue
273	System Supportability and Readiness	The NPS assessment team is concerned that variance in IT environments will complicate installation.	infrastructure requirements	2	All MDA Tech	QRA
274	System Supportability and Readiness	NORTHCOM is concerned that its IT facilities may not be able to accommodate additional technology.	infrastructure requirements	2	All MDA Tech	Workflow, PEW
275	System Supportability and Readiness	ONI is concerned that additional power capacity may be needed to run additional technology.	infrastructure requirements	2	All MDA Tech	Workflow, PEW
282	System Supportability and Readiness	ONI is concerned with adequately staffing for MDA technologies.	staff size and competency	2	All MDA Tech	Workflow, PEW
283	System Supportability and Readiness	NAVCENT is concerned about manning and maintaining MDA technologies.	staff size and competency	2	All MDA Tech	n.a.
284	System Supportability and Readiness	CINCPACFLT and NAVCENT state that they will require additional staff to operate and maintain the technologies.	staff size and competency	2	All MDA Tech	Workflow, PEW
288	System Supportability and Readiness	CINCPACFLEET is concerned about the feasibility of learning, using, and maintaining new MDA technologies given that it has a small intel unit.	staff size and competency	2	All MDA Tech	Workflow, PEW

7.0 Appendix A: Workflow Architecture Results

The Naval Postgraduate School (NPS), under contract to OPNAV N3/N5, conducted an analysis of current, MDA-related workflow in selected venues and identified potential concerns about the impact of Spiral-1 technologies on that workflow. This appendix reports on the methodology, findings, and recommendations of that study. Detailed results of that effort were reported 1 March 2008 (see report NPS-IS-08-002).

7.1 Method

The objective of the workflow analysis was to define the current – or "as is" – flow of MDA tasks in a representative sample of organizations, and to capture issues of concern to those organizations regarding MDA Spiral-1 technologies.

The NPS research team elicited information about workflow and technology-related issues in interviews[3] with CINCPACFLT, MIFCPAC, NMIC/ONI, and NAVCENT. (Additional data were gathered in a Process Engineering Workshop and a Process Alignment Workshop, both reported in a subsequent appendix). We conducted two types of analyses using these data.

1. A qualitative analysis was performed to identify areas of concern and generate recommendations concerning Spiral-1 technologies and process.
2. A process analysis was performed to define (1) current MDA tasks, (2) the entities that execute them, (3) the precedence relationships (or flow) between those tasks, and, when possible, (4) the media used to communicate between tasks, (5) the products of those tasks, and (6) the potential application points for Spiral-1 technologies. Representatives of more than 20 organizations reviewed and revised the workflow products[4] in two workshops – a Process Engineering Workshop and Process Alignment Workshop reported in section 8.0.

Recommendations from this research were developed after completing the field research and workshop, and are reported at the end of section 8.0.

[3] The opinions of the informants may not accurately represent the position of their organizations.
[4] The MDA workflow is documented in report NPS-IS-08-002, available upon request. NAVNETWARCOM (through its contractors WBB Inc. and Booz Allen Hamilton) elaborated these data to create DoDAF OV-6c diagrams of MDA activities.

7.2 Findings

Qualitative findings from the interviews are presented here in detail. They are organized by the data collection event in which they were collected: (1) interviews with CINCPACFLT, MIFCPAC, NMIC/ONI, and NAVCENT, and (2) a Process Engineering Workshop attended by representatives from a variety of organizations.

7.2.1 Interviews at CINCPACFLT

Representative of the NPS research team met with the CPF N2 MOC Director and overall MDA Lead for N2 during the period 22-28 October 2007 (Kurtz, 2007). The interview was informal, and focused on the organizational and mission environment for Trident Warrior technologies.

Interviewees raised several issues related to MDA technologies:

- The MOC to be stood up by 31 Jan 2008 will have a traditional organization. It will not include ONA; that function will be executed by N2. The intelligence staff is quite small (CPF N2 currently has 2 Information System specialists and one is an E-9), though there is an effort underway to extend the human resources by combining the CPF Intel Watch with the PACOM JIOC. Given the small size of its intelligence unit, CPF is concerned about the feasibility of learning, using, and maintaining new MDA technologies.
- CPF does not need to maintain awareness of white shipping for its routine operations, though the capability is seen as potentially useful. However, CPF does need this capability to support one, highly complex OPLAN (intentionally unnamed, here). Thus, use of Spiral-1 technologies may be sporadic or localized to very few staff.

7.2.2 Interviews at MIFCPAC

Representative of the NPS research team met with representatives of MIFCPAC 7 January 2008 (MacKinnon & Hutchins, 2008). The interviews were informal. They focused on how MDA is viewed and accomplished by the Coast Guard at MIFCPAC with special attention to current and potential usage of Spiral-1 technologies.

The interviewees raised several issues related to MDA Spiral-1 technologies:

- MIFCPAC is responsible for all vessels approaching the US from continents except Europe. The organization provides considerable support to CINCPACFLT, which has a small staff (see section 0). However, MIFCPAC is focused on the Coast Guard mission, which concerns both terrorism and regulatory issues such as fisheries and pollution. Thus, its use of Spiral-1 tools may be unusual. For example, MIFCPAC may need alerts that

discriminate reliably between loitering in fisheries by (1) American vessels and (2) potentially illegal foreign fishing vessels.

- MIFCPAC sees value in selected MDA technologies. It is already using CMA to support analyses (such as the fisheries analysis, above), and it sees promise in Google and Global Trader. MIFCPAC argues that FASTC2AP may not be "viable" for its uses.

7.2.3 Interviews at NMIC / ONI

Representatives of the NPS team interviewed several staff of NMIC/ONI 23 October 2007 (Freeman and Hutchins, 2007). The interviews were structured to elicit comments about (1) a draft workflow for MDA activities surrounding a tracking and E-MIO scenario and (2) the utility of MDA Spiral-1 technologies for their activities. NPS interviewed: an information systems manager, a Watch Floor COP manager, and a specialist in boarding operations and data. An informal interview was conducted with the head of the Advanced Maritime Analysis Cell, and with the lead for a DoDAF architecture effort focused on the intelligence day shops. All interviews were held at the unclassified level.

Data were gathered that extended the MDA workflow model. In addition, the interviewees raised several issues related to MDA Spiral-1 technologies:

- ONI continuously monitors 220-350 Vessels of Interest (VOIs). The watch floor – staffed by 13 people – handles as many as six formal Requests for Information (RFIs) daily about these and other vessels, 15-20 informal external requests daily, and a small number of ONI internal queries. The watch forwards approximately one formal RFI to analysis cells (or “day shop”, e.g., counter-terrorism, counter-narcotics, counter-proliferation, homeland defense) each day. ONI’s capability to handle this current volume of tasking is hampered by difficulty sharing track data across the Navy, insufficient training resources, insufficient staffing for some activities (e.g., analysis of biometrics findings), and rapid turnover of staff on the watch floor. NMIC/ONI is recruiting several hundred additional staff. However, staff capacity is currently a concern.
- Several Spiral-1 technologies are seen to have particularly high value within ONI or as data feeds to it: CMA, TRIPWIRE, TAANDEM, FASTCAP, and EMIO wireless. However, ONI expressed concern that (a) the interoperability and integration of these and other tools (e.g., with GCCS) was not defined; (b) the process for accrediting new tools for operational use is long (approximately and months) and somewhat uncertain; (c) the tools primarily increase the volume of data available for analysis but do not help analysts to manage those data; (d) the tools do not strongly enhance the capability to rapidly, reliably predict activity given cyclical and emergent events, or infer intent or culpability from scant entity-relationship data; and (e) the provision of tools (e.g., Google Apps for collaboration) is insufficient to provide the intended capability (e.g., improved collaboration) without new processes and training.

7.2.4 Interviews at NAVCENT

Representatives of the NPS team interviewed several staff of NAVCENT 11-15 November 2007 (Freeman, J. and MacKinnon, D., 2007). The interviews were structured to elicit comments about (1) a draft workflow for MDA activities surrounding a tracking and E-MIO scenario, and (2) the utility of MDA Spiral-1 technologies for their activities. NPS interviewed: the ONA Director (N2), the Deputy ONA Director (N2), a Communications Information Systems officer (N6), an Information Management Officer (N6IM), the Deputy Director of Future Plans, ONI's embedded analyst in the ONA, an ONA MIO specialist, and several representatives of the COPS. All interviews were unclassified.

Data were gathered that extended the MDA workflow model. In addition, the interviewees raised several issues related to MDA Spiral-1 technologies:

- MDA supports, but is subordinate to the primary missions of NAVCENT: maritime security, anti-terror, and Iran. The prospect of receiving Spiral-1 technologies sparked several concerns: the relevance of the technology effort to primary missions, the shortage of personnel and high rate of turnover (10% monthly), concerns about training staff to use technologies effectively for NAVCENT billets and processes, concerns about system reliability and maintenance, the possibility of reduced manning as a result of MDA automation, and the prospect that the Flag might embark from NAVCENT. These concerns have led NAVCENT leadership to consider whether many MDA activities and Spiral-1 technologies should be housed at a JIOC or at ONI, provided that those institutions can reliably maintain awareness of NAVCENT's mission focus. That said, NAVCENT leadership views positively the potential Spiral-2 initiative to combine the shore-based radars of many nations with AIS data. This capability would benefit operations in the MOC, and also strengthen partnerships in the region.
- The knowledge of the Spiral-1 technologies among NAVCENT staff (at the time of the interviews) was scant, and so they had limited ability to assess the utility of these technologies. Watchfloor personnel see value in technologies that triggers or alerts concerning specific tracks. They state that they are unlikely to use technologies that require data mining or fusion across multiple sources.

8.0 Appendix B: Process Engineering & Alignment Workshop Results

The findings of field interviews results were validated and extended in two workshops, reported here: a Process Engineering Workshop conducted to vet the MDA workflow and a Process Alignment Workshop conducted to map the MDA workflow to the MHQ with MOC process architecture.

8.1 Process Engineering Workshop

The Naval Postgraduate School hosted an MDA Process Engineering Workshop (PEW) hosted by 15-17 January 2008. Representatives of the following organizations participated in the PEW: ASN RDA, C3F, COTF, Dept. of the Under Secretary of the Navy, DISA, HFE LLC, JITIC, METRON, MIFCLANT, MIFCPAC, NAVCENT, NAVNETWARCOM, NCIS, NORTHCOM, NPS, NRL, NWDC, ONI, OPNAV, PMW 120, and SPAWAR. Also participating were subject matter experts (SMEs) from several of the MDA Spiral-1 technologies, domain experts ('gray beards'), representatives from the Trident Warrior 2008 (TW08) operational experiment where many of the MDA Spiral-1 technologies will be assessed, and members of the assessment team (NPS, Aptima, Pacific Sciences & Engineering, WBB Inc.).

Participants in the Process Engineering Workshop assessed the utility of Spiral-1 technologies for each MDA activity. In general, PEW participants asserted that each organizational node that had access to any Spiral-1 technologies would use all of those technologies in most of its activities. Thus, the activities (below) that involve ONI and ONA make heavy use of Spiral-1 technologies because (1) many of the Spiral-1 technologies are designed to support intelligence analysis and (2) many of these technologies will be inserted at ONI and ONA.

Activities conducted by COPS, FOPS, the MOC Director, and BWC are not expected to benefit from many of the technologies, according to PEW participants. One exception is the task "MOC Director: Define CDRs Estimate & COA", a task in which the MOC director may draw on the Common Intelligence Picture (CIP), Common Operational Picture (COP), and other data sources to develop, critique, and select courses of action.

We note that the assessment of Spiral-1 utility by PEW participants conflicts somewhat with the assessment by the NAVCENT MOC. In particular, NAVCENT anticipates that (1) the BWC would use FASTC2AP and SMS/JPSC2 to execute task "Assess Tactical Asset Availability" and the IWO would use FASTC2AP to execute task "Issue RFI." In general, NAVCENT and the PEW agreed in their assessment that ONA would use a variety of Spiral-1 technologies in its intelligence analyses. NAVCENT indicated that CMA, MAGNET, FASTC2AP, Google Earth, and SMS/JPSC would be particularly useful to ONA. These differences in perspective between NAVCENT and PEW participants are indicated with a * in the table below.

Activities executed by Fleet assets make almost no use of the technologies in the table below, because the Fleet activities do not require most of the analysis functions provided by these

technologies or because Fleet assets are not expected to receive them. E-MIO is a notable exception; Fleet assets will receive E-MIO and will benefit from it, per the table, below.

Note that Table 17 does not include mappings of technology to activities for early-stage, intelligence generation activities (by MARLO, CIFC, NCIS, the COCOM, the International Maritime Bureau, etc.) nor to MOC-to-MOC handoff activities.

Table 17. The perceived utility of Spiral-1 technologies for each MDA.

Entity	CMA	TAANDEM	MAGNET	FastC2AP	Global Trader	Tripwire	E-MIO Wireless	Google Apps & Chat	Google Earth	SMS/ JPSC2	LInX	Austr AIS
ONI: Intel	X	X	X	Tbd	X	X		Tbd	Tbd	X		Tbd
ONA: Nominate potential VOI	X	*X	X	X					*	*		
ONA: Validate/(Re)Prioritize VOI	X		X	*		*X		*X	X	*		
MOC Director: Receive/Decide/Route VOI									X			
COPS: Process VOI												
FOPS: Process VOI												
BWC: Assess Tactical Asset Availability				*						*		
MOC Director: Define CDRs Estimate & COA	X	X		X		X		X	X		X	
CNO/NOO: Approve COA	X							X	X			
MOC: Coordinate MOC-to-MOC Handoff	X							X	X			
IWO: Issue RFI				*								
ONI issues RFI to MOC	X	X	X	X	X	X		X	X		X	X
ONA: Process RFI (Issue, Fulfill, Assess Fulfilled)	X	*X	X	X	*X	*X		*X	X	*	*X	*X
ONI: Process RFI (Issue, Fulfill, Assess Fulfilled)	X	X	X	X	X	X		X	X	X	X	X
NCIS, CIFC, MARLO, MIFCPAC, NGA: Process RFI								X	X	X	X	
BWC: Communicate Mission Orders												
Fleet Asset: Plan & Direct VBSS Mission												
Fleet Asset: ISR Data Collection												
Fleet Asset: Take Biometrics/Boarding Data							X					
BFC: Analyze Biometrics												

Entity	CMA	TAANDEM	MAGNET	FastC2AP	Global Trader	Tripwire	E-MIO Wireless	Google Apps & Chat	Google Earth	SMS/ JPSC2	LInX	Austr AIS
ONI: Analyze biometric findings					X	X					X	
NGIC/ONI: Store biometric report												
ONI: Analyze Boarding Data	X	X	X	X	X	X					X	
Fleet Asset: Receive Boarding Data Analysis							X					
ONA: Analyze Findings	X	*X	X	X	*X	*X		*X	X	*	*X	*X
Coalition: Execute VBSS Mission												
COPS: Monitor VBSS												
COPS: Recommend Change Mission/Revision of CAT Level												
COPS: Recommend Mission Complete												
ONA: Monitor Vessel of Interest on Watch List	X	*X	X	X	*X	*X		*X	X	X	*X	*X

Note: An "X" in this table indicates that the activity would benefit from the Spiral-1 technology in the opinion of PEW participants. A "*" indicates that the assessment by NAVCENT MOC is contrary to the PEW assessment.

Participants in the PEW also offered a number of concerns about fielding Spiral-1 MDA technologies. Many of these concerns are typical for a technology insertion program, and thus they represent challenges of program management and customer expectation management.

- Customization of MOCs
    - Organizational structures and missions (that compete with MDA) vary between COCOMS and MOCs. MDA TTPs need to be sufficiently flexible to accommodate these differences. Alternatively, a variety of TTPs (e.g., for small vs. large MOCs) may be needed.
- Manning
    - Current Navy guidance does not require a reduction in manning resulting from implementation of Spiral-1 technologies. NAVCENT and PACFLT have stated that they will require additional staff to operate and maintain the technologies.
- Technology capability

- Some Spiral-1 technologies are prototypes. In at least one case, the technology SME warns that these technologies may not be sufficiently robust for use by operational forces (e.g., false alarm rates may be too high), and that their proper place for now is at *reachback* institutions (such as NMIC/ONI) that have the backup capacity to overcome these potential failures. Other stakeholders have expressed concern about specific technologies: CMA (number of databases delivered vs. number of databases promised), TAANDEM (accreditation challenges), FASTC2AP (maturity of the alerting capability).

- Training
  - NAVCENT and PACFLT have expressed concern that training products be delivered with the systems, and that this training address organization-specific applications of the technology.

- Technology Installation
  - Standardization: The unique IS environments across the fleet will present a challenge to technology installers.
  - Physical capacity: Some sites do not have the physical space to accommodate additional technologies, particularly if each technology is delivered on a separate server. NORTHCOM is a case in point. It can expand its IS spaces for new servers only by blasting additional rooms into the mountain.
  - Power capacity: The old infrastructure at some sites constrains insertion. ONI, for examples, requires additional electrical power for every significant technology insertion. Delivery of additional power can take half a year or more.

- Testing
  - Metrics are needed to assess the effects of technology insertion relative to the current state. Unfortunately, there are few if any published standards that define the effectiveness of current solutions in operations. (Standards for the Navy Task List pertain to training, not operational use, for example).
  - A sufficiently detailed scenario is needed to drive testing. This scenario must systematically address the variety of MDA data types (vessel, people, cargo, etc.), reporting products, node interactions, and time course of activity in a problem that involves discovery, analysis, and prosecution of VOIs. Particularly important challenges in MDA are: ISR management, collection planning, decisions regarding opposed and unopposed boardings, and tracking neutrals. In addition, scenario designers should consider events in which multiple vessels collaborate in a threat incident, either through cargo transfer between vessels or by synchronized tactical actions of two or more vessels. TW08 is developing a scenario using systematic methods.

- Process Analysis
  - Additional detail is needed concerning intelligence analysis processes (monitor, collect, fuse, analyze, and disseminate). This analysis is being conducted

independently by ONI, but that process has only recently begun (e.g., analysis of one day shop was completed as of November 2007) and so the results may not be available to support Spiral-1 testing.

- The MDA workflow should be aligned with the MHQ w/MOC process architecture. This was successfully addressed in a Process Alignment Workshop 29 January 2008.

8.2 Process Alignment Workshop Results

A Process Alignment Workshop was held to align the MDA task with MHQ w/MOC processes. The participants in the workshop were approximately 20 warfighting functional area leads, system and process architects, process SMEs, and interoperability experts. Tim Sorber of Klett Consulting and the Second Fleet MHQ w/MOC architecture team organized the session and co-led the workshop with Dr. Jared Freeman (Aptima) for the NPS team, and Greg Allen of WBB.

Participants mapped (1) OV6C diagrams of MDA activities to (2) the MHQ with MOC process architecture "SmartPack." The OV6C was developed by NAVNETWARCOM (by contractors WBB and Booz Allen Hamilton) based on MDA workflow diagrams developed by NPS (see section 4.4).

The workshop participants concluded that virtually all MDA activities mapped to MHQ with MOC processes, though some MDA tasks specific to handoff between MOCs had yet to be addressed in the MHQ with MOC architecture at that time. Several other minor recommendations were made to revise the documents. These are specified in Technical Report NPS-IS-08-002, available from NPS.

8.3 Recommendations

On the basis of the PEW findings and the field analysis of MDA workflow (above) the NPS assessment team made more than a dozen recommendations concerning Spiral-1 MDA technology, its fielding, and its assessment.

(1) Pay particular attention to planning and socializing the plan to train and maintain support Spiral-1 technologies. This may allay concerns in CINPACFLT, NAVCENT, and elsewhere that the technology delivery is not paying sufficient attention to the human factor.

(2) Training for Spiral-1 technology users and maintainers should be rapid, demonstrably effective, and customized to local missions and procedures. This will address concerns that technology won't support local missions and processes for staffs with high turnover

(3) Given the potential that staff will use new MDA technologies infrequently in some organizations, they may forget how to use the technologies efficiently and well. Usability, training, and technical support will be particularly important predictors of success in these organizations. These should be a focus of assessment

(4) Technology providers should continue to brief user communities concerning the maturity and delivery schedules for technologies. This may help users to prepare for the specific capability they will receive

(5) The accreditation process must be carefully managed across the Spiral-1 technologies. Lessons learned should be used to accelerate that process.

(6) Interoperability issues should be assessed and managed carefully. Interoperability reduces training requirements, facilities requirements, and cognitive load (imposed when users must remember results from one system while they use another, or fuse information mentally).

(7) Technology roll-outs to NAVCENT should be (1) selective, to respect NAVCENT's vision of its role and capabilities, and (2) strongly supported with training and technical aid to ensure that NAVCENT evaluates those technologies in the most positive light.

(8) In deliveries to NAVCENT, emphasis should be placed on technologies that support alerting over technologies that support data mining and fusion, for which NAVCENT is not currently well staffed.

(9) Technology roll-outs to MIFCPAC should be (1) selective to support the organization's missions, and (2) include support to customize the technology for regulatory enforcement missions.

(10) Technologies with low accuracy or reliability should be placed in reachback centers rather than front line operational centers.

(11) Spiral-1 fielding will require attention to marked differences between installation environments with respect to physical space, power capacity, etc.

(12) Technology assessments should focus largely on the effects of Spiral-1 insertion on (1) access to information that was previously inaccessible or difficult to access, (2) speed of decision making, and (3) accuracy of decision making. Measures on these activities will be of great interest to user communities.

(13) The MDA assessment should accurately measure the impact of new technologies on training and maintenance requirements for Spiral-1 technologies relative to current requirements. This will help user communities predict and manage these costs.

(14) MDA "to be" process must be standardized to ensure the interoperability of MDA stakeholders, but customized to local missions and capabilities. This is a

significant challenge. It is one faced by the MHQ w/MOC process architecture team, and their strategies should be studied and applied here.

(15) A “to be” workflow for MDA at ONI using Spiral-1 technologies should be developed in collaboration with the team that is conducting DoDAF modeling of ONI analysis processes.

In addition, a review of the MDA workflow (not reported here) indicated the potential for increased volume of information flow from intelligence entities to operational entities. The following recommendation was made:

(16) Measure and manage the rate of information flow from intelligence entities to the MOC to ensure that the MOC is able to accurately filter, prioritize, and process incoming intelligence.

8.4 Workflow Architectures

These OV-6C diagrams of MDA process were developed by NAVNETWARCOM contractors WBB and Booz Allen Hamilton from workflow data and diagrams developed by NPS.

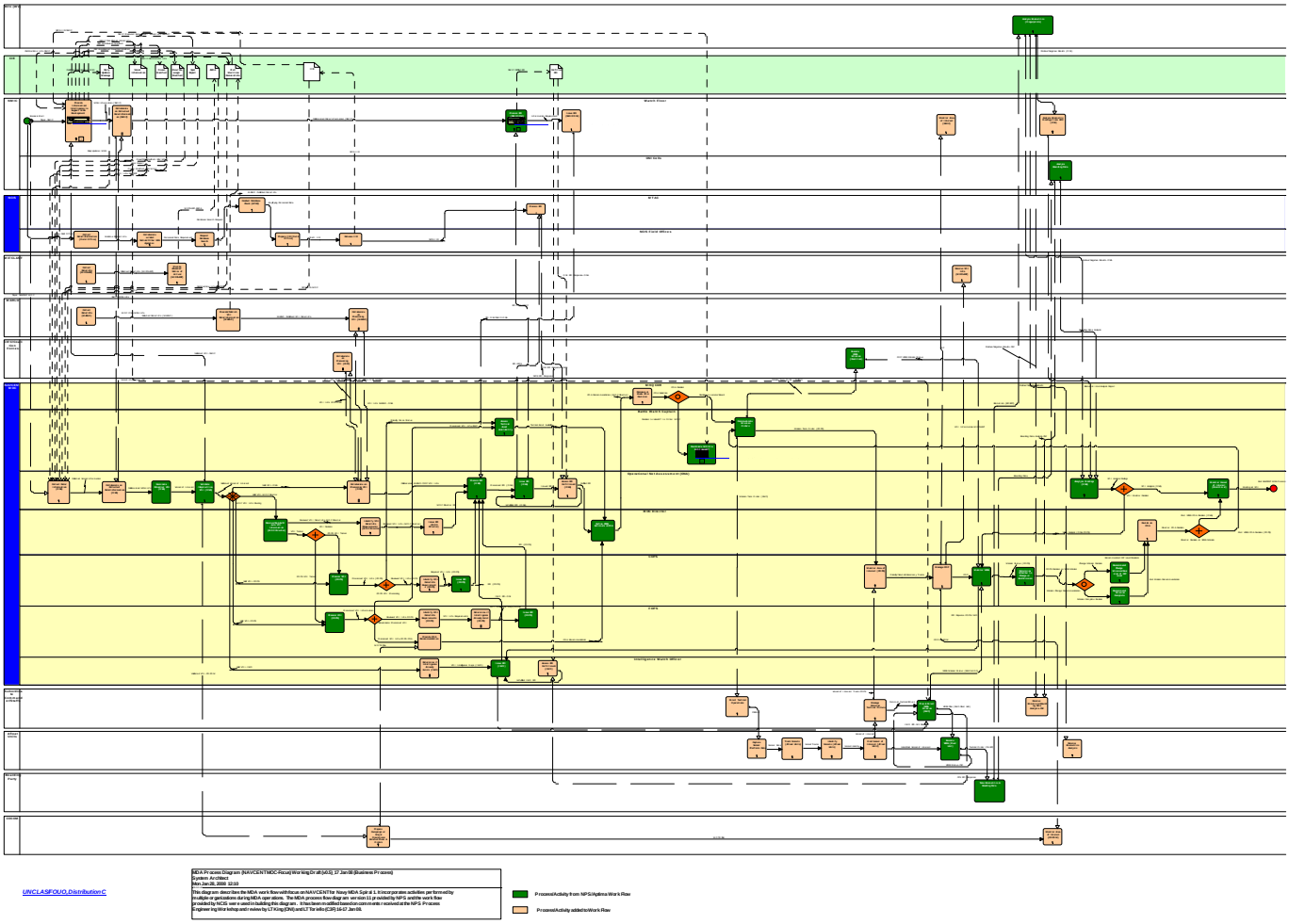


Figure 1. MDA OV6C: Top Level Process.

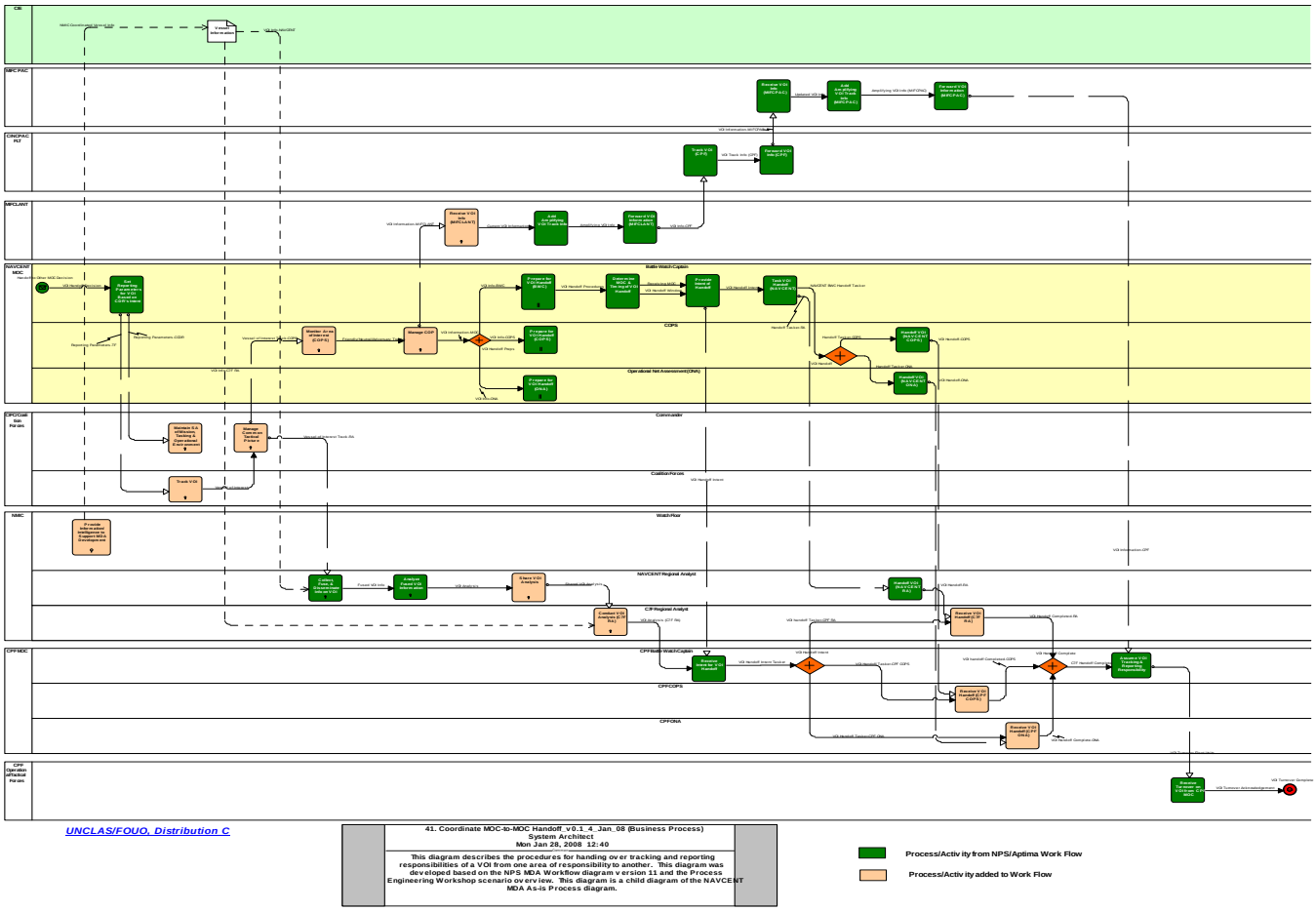


Figure 2. MDA OV6C: Coordinate Handoff

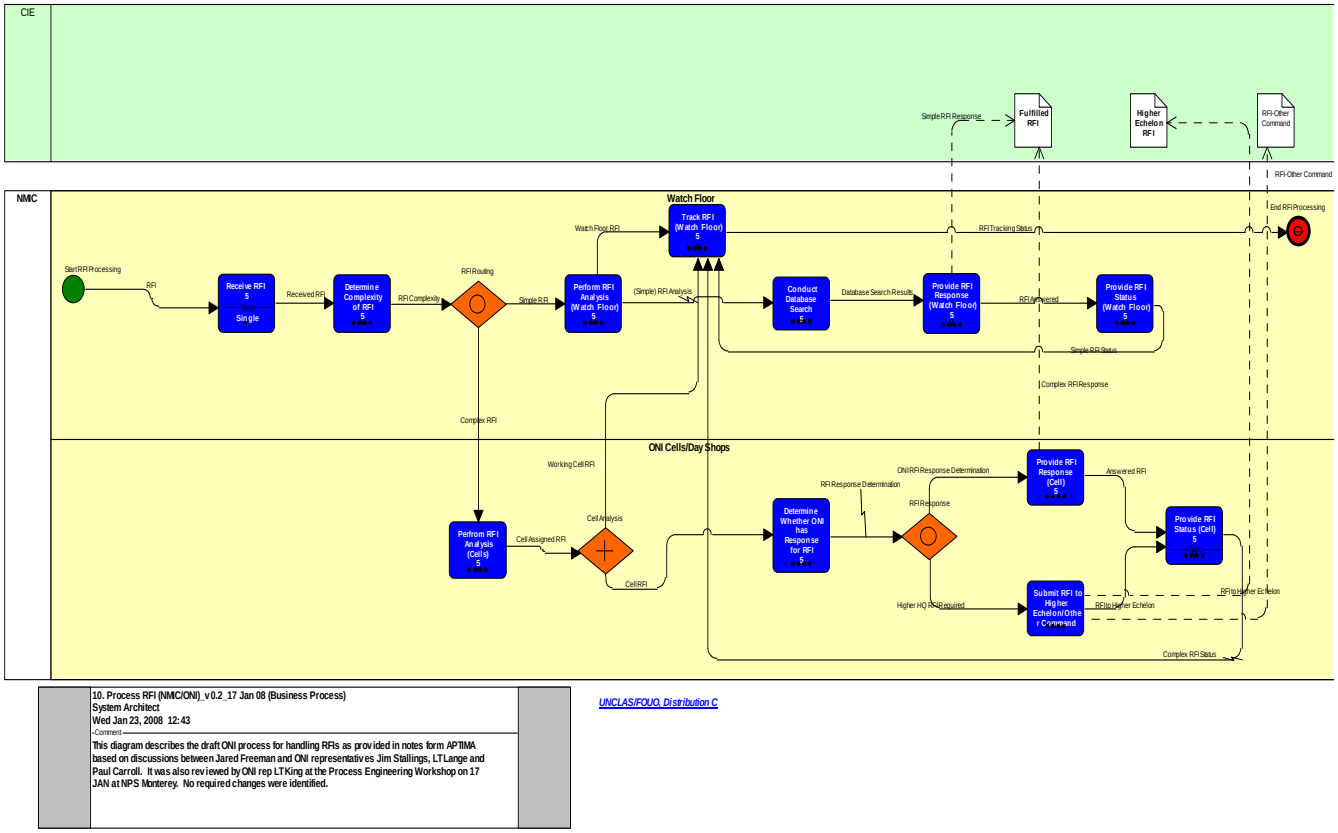


Figure 3. MDA OV6C: Process RFI

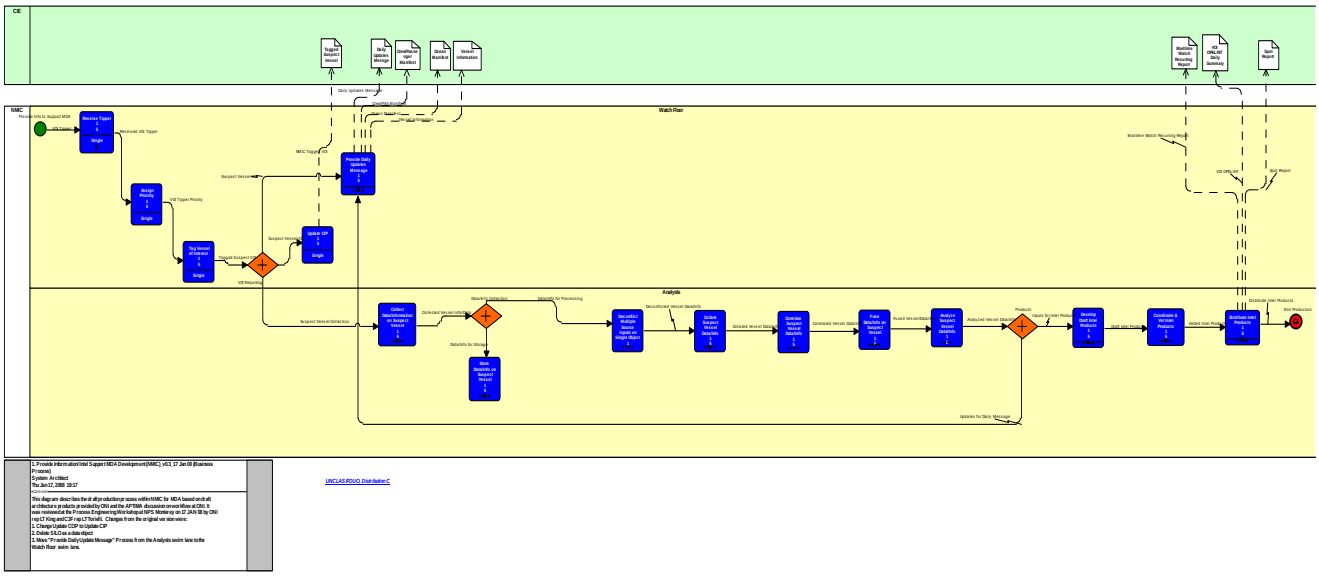


Figure 4. MDA OV6C: Provide Info/Intel

8.5 MDA Workflow

The workflow documents presented below define workflow within an organization or, when that organization has many activities, within a cell or role. The workflow incorporates data developed by NPS in interviews and workshops, as well as inferences made by NAVNETWARCOM contractor WBB (and verified in the workshops above). These data are represented in the MDA OV-6C data developed by NAVNETWARCOM. The graphs, below, were generated from a current version of that data set delivered by Booz Allen Hamilton to Aptima on 29 February 2008.

The following conventions are used here:

- The activities of a specific organization, cell, or role are framed in a rectangle. Their interactions with other entities are indicated by arcs to nodes outside that rectangle.
- Each activity node specifies:
    - The activity (e.g., Prepare IIR) or information product in the Collaborative Information Environment (CIE)
    - The entity who performs the activity (e.g., NCIS)
    - In some cases, the corresponding MHQ w/MOC Core Process. (The mapping of MDA tasks to Core Processes was conducted for high-level tasks only. Tasks that are not marked with Core Processes here are subordinate to other tasks that are so marked.
    - The node identifiers from DoDAF data.
- Where multiple arcs emerge from a node, these sometimes represent options (“or”, not “and”).

The reader can view these detailed images by expanding them (select and drag the corners) and zooming the view. These images are jpeg files that should port well to other applications for better viewing.

The data, scripts, and application used to generate these graphs are available upon request.

Figure 5 depicts all MDA workflow identified in this project. Section 15.0 presents workflow diagrams for those units involved in MDA operations.

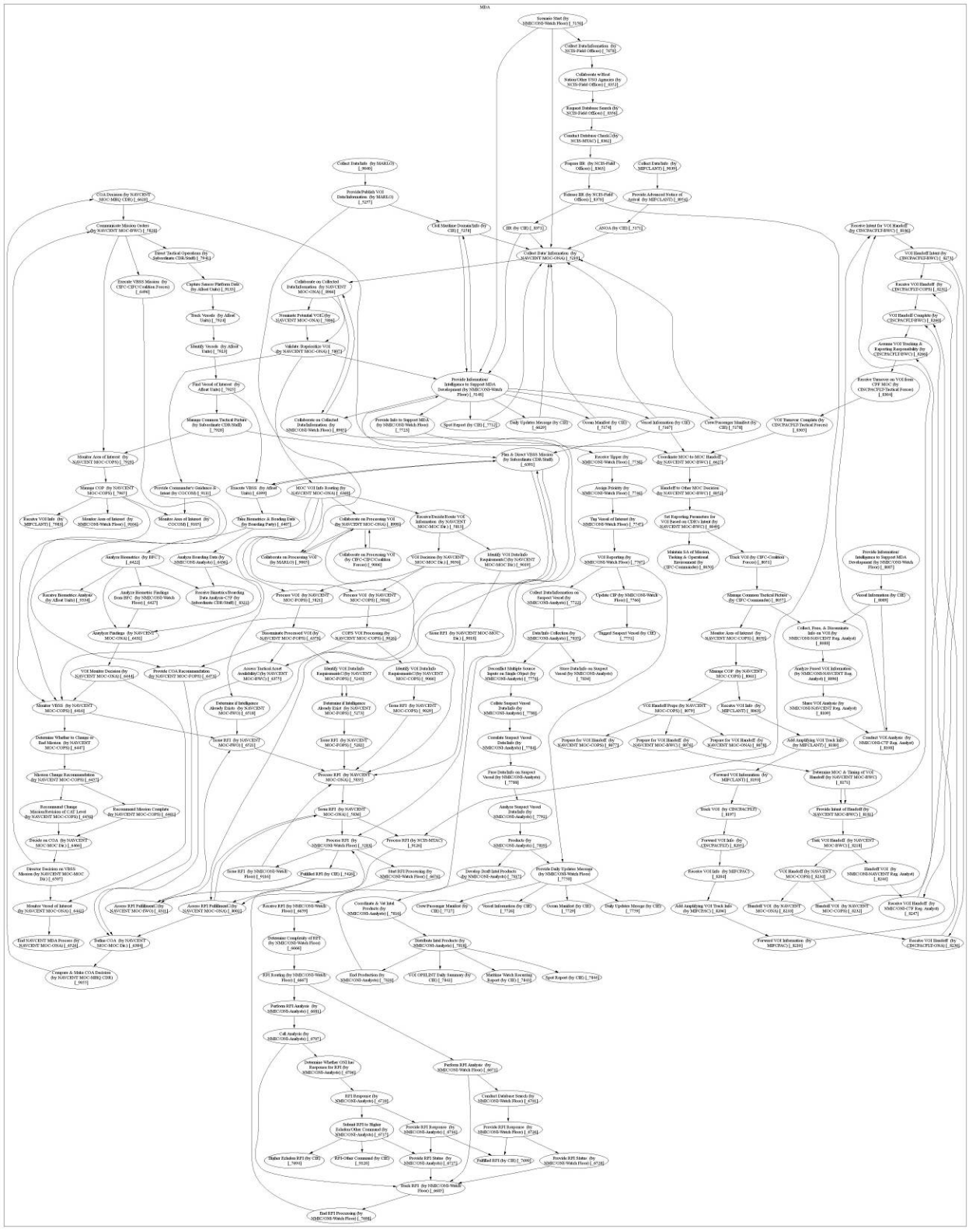


Figure 5. MDA Workflow

9.0 Appendix C: VBSS School Results

NPS officer students attended the Visit Board Search and Seizure (VBSS) School for training and to gather assessment information on the Tactical EMIO System (TES). The following is the report of LT Dalton Clarke.

On June 19, 2008 the second phase testing of the Tactical EMIO System (TES) was conducted at the VBSS School in San Diego. Testing planned for the evaluation and integration of 5 Tactical EMIO Devices (TED), 1 Tactical EMIO Maritime PC (TEMP), and Maritime BGAN EMIO Terminal (MBET). Figure 1 provides a TES Overview and illustrates the workflow process between the TED, TEMP, and MBET.

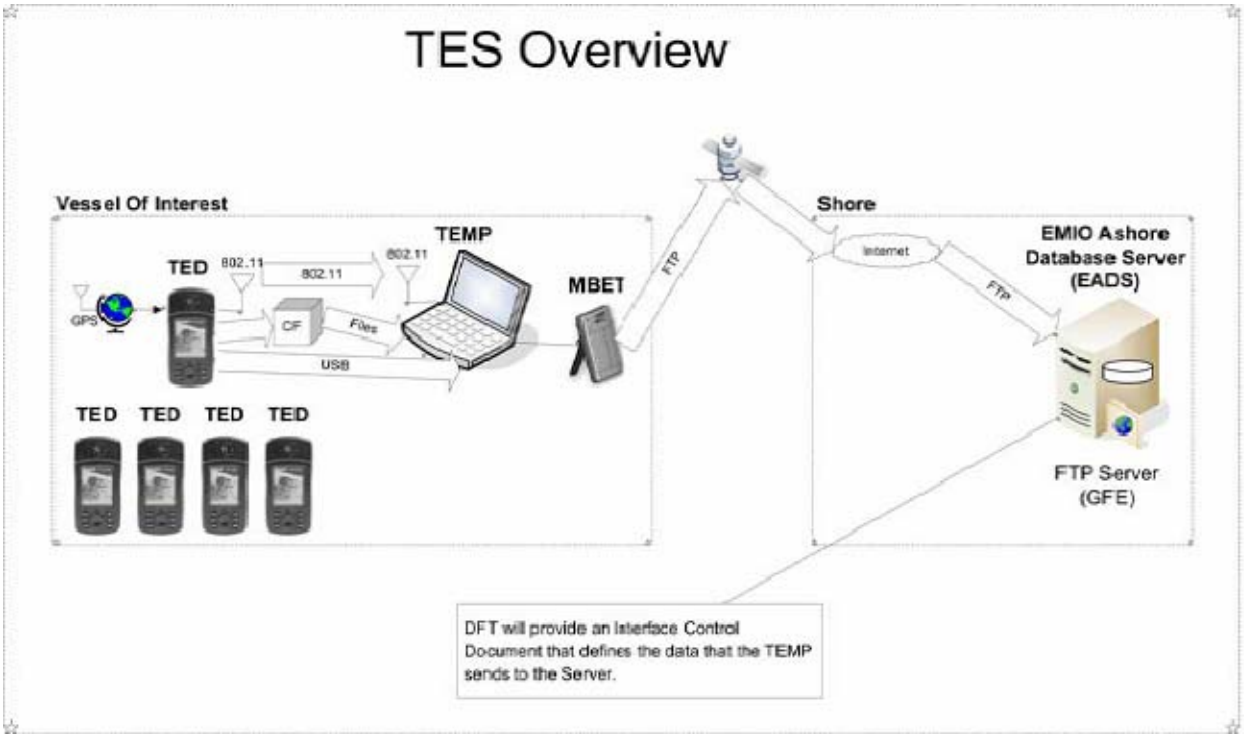


Figure 6. Digital Force Technology's (DFT) TES Overview

9.1 Training

Students 10 (in total) attending the VBSS School received 45 minutes of lecture and hands-on training in the use of the TED, TEMP, and MBET prior to fielding for experimentation on the USS RUSHMORE (LSD 48). The facilitator (civilian contractor) introduced all three EMIO systems while placing particular emphasis on the durability and user friendliness of the Graphic User Interface (GUI). TEDs were then given to the students to link to the TEMP via the wireless network (802.11). However, the TEMP had minor difficulties linking to the TED due to IP address issues. Students were able to configure their TEDs for data capturing objectives once 802.11 links were established between the TEMP and TED. Due to time constraints, students could not link units to the MBET system for data transfer. Baseline training surveys were given to all 10 students which indicated that they had a basic understanding about the operation of the EMIO units.

9.2 Experimentation

Testing commenced at 16:46. Students boarded the target vessel USS RUSHMORE via small boats and hoisted up all of EMIO units incased in a bag. Contractors assisted students using 2 of 5 TEDs due to limited training conducted on TED units. Data capturing commenced once the vessel was secured by VBSS teams. The Boarding Officer assigned specific data objectives through the TEMP device for the TED devices to complete. Individual data was collected from crew members located in DC Central and Officer Country. Once all data objectives were completed, TED devices were brought to the pilot house to transfer data to the TEMP device. Although wireless, the TED devices were required to be in the vicinity of the TEMP in order to download data captured during the boarding. The RF signals were not strong enough to transmit data when team members were below decks. The MBET device, in turn, failed to transfer data due to environmental issues and weak RF signal range of commercial satellite. Contractors eventually departed the target vessel and drove inland with the TEMP and MBET device to acquire a stronger signal. The MBET link was then acquired and successfully transmitted data from the TEMP device. Neither the Boarding Officer nor the students witnessed the data transfer. Contractors asserted that the satellite connectivity will not be a concern in the current AOR. An EMIO general user survey was given to VBSS members who operated TED and TEMP devices. Surveys evaluating the practical operation of the MBET device were not handed out due to students having little interaction with the device.

9.3 Observations

With regard to training, students were not granted enough time to practice operating all three systems (TED, TEMP, and MBET). Students asked many questions during the training which provided useful feedback for the contractors to learn the perspective of the user. Some questions focused on why the units did not incorporate biometrics and camera capabilities into one unit. The contractor explained that biometrics were not included due to privacy issues and that these units, thus far, were not being used by coalition forces. He anticipated that the camera will be incorporated in the next version of EMIO system.

Observing the practical operation of the TED in the field, indicated that the students would require additional training to fully operate the TED. Yet, the students were able to use the features effectively to capture required data. Additionally, mobility of the TED was a clear advantage allowing for the collection of data from multiple locations within the vessel. One limitation noted was that the TED must be within the vicinity of the TEMP to download the data captured. The Boarding Officer was not able to demonstrate the transfer of data via the MBET due to the satellite connectivity concerns mentioned above.

Observations of the MBET demonstrated that:

- Its design was very rugged and seemed to prevent water intrusion.
- A heat sink was also attached to dissipate heat.
- The support handle for the MBET will eventually require a different material to prevent salt water corrosion.
- The MBET device was not light enough to be carried on a VBSS person.

Students indicated via user surveys that:

- The equipment should integrate the camera along with biometric capability
- The TEDs had too many functions to organize the data.
- They would prefer less required steps to configure the system
- The EMIO gear was very mobile
- The graphic user interface was intuitive and simple to use.

The survey for the MBET was not filled out due to the lack of training and satellite connectivity concerns.

10.0 Appendix D: FAIRGAME QRA Results

The following is the QRA results message, modified to change from message format to one easily read. The content has not been changed.

10.1 Purpose

This is a report of COMOPTEVFOR's Quick Reaction Assessment (QRA) of the Maritime Domain Awareness (MDA) Spiral-1 prototype leave-behind MDA capability. Per Refs A and B, the purpose of the QRA was to determine potential operational effectiveness, potential operational suitability, and considerations for deploying leave-behind technologies at identified nodes. Additionally, the adequacy of training, documentation, and the ability to locate, analyze, and pass target information to other nodes, and receive analytically derived information from queries to National Maritime Intelligence Center (NMIC) were to be assessed.
Per Ref D, the QRA was conducted from 16 Jun-23 Jul 2008. Per Ref E, user feedback was solicited and provided a majority of this report's findings.

10.2 Summary

MDA Spiral-1 is potentially operationally effective and potentially operationally suitable. Leave-behind technologies will enhance the warfighter's ability in maintaining situational awareness of the global maritime domain.

- MDA related training and documentation provide the basic building blocks to employ the MDA suite but require considerable modification and review.
- MDA Sprial-1 provided useful information on vessel location, cargo, and people.
- However, the ability to conduct analysis was limited by incomplete data at each node.
- The ability to collaborate between nodes was affected by the lack of commonality of data at the nodes.
- Users did not have information on how or what global data was provided to the nodes and had difficulty resolving discrepancies and constructing track histories.

10.3 Scope of Assessment

The QRA assessed the following Spiral-1technologies: Comprehensive Maritime Awareness (CMA) Joint Capability Technology Demonstration (JCTD)

- Law Enforcement Information Exchange (LINX)
- Cargo Link
- Maritime Awareness Global Network (MAGNET)
- Fast Connectivity for Coalition and Agents Project (FASTC2AP)
- TRIPWIRE Analytic Capability (TAC)
- Google Earth Fusion Services

- Tactical Expanded Maritime Interception Operations System (TES)
- MDA Data Sharing Community of Interest (MDA DS COI),
- SEAPORT Collaboration at Sea (SEAPORT CAS),
- Sensor Management Systems/Joint Perimeter Surveillance Command and Control (SMS/JPSC2).

The technologies were not integrated to act as a system-of-systems capability, but rather as independent capabilities, with no two nodes having the same Spiral-1 capabilities, set-up, or MDA focus area.

10.4 Project Testing

The assessment was conducted at three venues: Trident Warrior 08, Navy Visit Board Search and Seizure (VBSS) School, and SPAWAR-Sponsored Exercise FAIRGAME 08-2.

A. Trident Warrior 08. Trident Warrior is an annual experiment which examines new technologies and processes among operational fleet users. Trident Warrior 08 hosted a subset of the Spiral-1 suite (LINX, CMA, CARGO LINK, and MDA DS COI) at COMPACFLT, Maritime Intelligence Fusion Center Pacific (MIFCPAC), C3F, MIFCLANT, NMIC, and various NCIS field sites.

B. The Navy VBSS school in San Diego hosted the TES demonstration.

C. FAIRGAME 08-2. FAIRGAME 08-2 was a SPAWAR sponsored event that facilitated the demonstration of the Spiral-1 suite capabilities. FAIRGAME hosted the entire Spiral-1 suite with the exception of LINX and operational testing of the RES at COMUSNAVCENT. The sites represented were COMUSNAVCENT, COMPACFLT, MIFCPAC, MIFCLANT, and NMIC. The SPAWAR T&E team assisted by the SSC San Diego Advanced Concept Engineering Laboratory (ACE lab) acted as White Cell.

D. MDA MISSION AREAS. The MDA mission are differed according to COCOM and Area of Responsibility (AOR). Because of the mission area differences, user feedback varied by node.

10.5 Limitations

A. The TES system was demonstrated using U.S. NAVY VBSS operators vice intended coalition users.

B. The time period between technology installation and the QRA was not sufficient for the user to become proficient at using the new tools. Some user feedback is based on little or no training.

C. U.S. NAVY users did not have direct access to the MAGET system. MAGNET data was only accessible through CMA and was not tested as a stand-alone capability.

D. The AIS system was accessible only through CMA, MDA DS COI, and Google Earth and was not tested as a stand-alone capability.

E. The Global Trader system was accessible only via Cargo Link web access and was not tested as a system.

F. Limited capability to extract data from MDA Spiral-I systems and limited time to analyze the extracted data limited the QRA primarily to qualitative methods. Because of time limitations, quantitative measures were scored on only a small sample of the extracted data.

G. Real-world data was used as ground truth for the FAIRGAME scenarios and, as such, some capabilities may not have been fully observed due to exercise limitations.

H. The San Diego SMS/JPSC2 system was not observed as a stand-alone system. However, SMS/JPSC2 data were observed via the MDA DS COI.

10.6 Observations

A. The critical operational issue assessment was of Spiral-1 technologies functionality as operated during this assessment.

White = not assessed/tested
Green = sufficient functionality
Yellow = partial functionality
Red = limited functionality

EFFECTIVENESS CRITICAL OPERATIONAL ISSUES

E-1 Monitor	Yellow
E-2 Collect	Yellow
E-3 Fuse	Green
E-4 Analyze	Red
E-5 Disseminate/Collaborate	Yellow
E-6 Operating Picture	Yellow
E-7 Communications Capability	Green

SUITABILITY CRITICAL OPERATIONAL ISSUES

S-1 Reliability	Green
S-2 Maintainability	White
S-3 Availability	Green
S-4 Logistic Supportability	Green

S-5 Compatibility	Green
S-6 Interoperability	Green
S-7 Training	Yellow
S-8 Human Factors	Green
S-9 Safety	Green
S-10 Documentation	Yellow

B. EFFECTIVENESS CRITICAL OPERATIONAL ISSUES

(1) *E-1 Monitor. Will MDA Spiral-1 technologies enhance the warfighters ability to monitor the global maritime domain?* (YELLOW)

- CMA provided searchable data on vessel location, cargo, and people but there were gaps in track data, a lack of commonality of data between nodes, and insufficient information on data sources.

- The user's ability to monitor vessel, person, and cargo data was severely degraded by gaps in track data coverage. When a node's CMA server was down, or data was not transmitted, the data not received was not recoverable. The Naval Research Laboratory (NRL) limited the National Technical Means (NTM) data source input to CMA to 14 hours per day and filtered the data that was provided. This resulted in a gap of data which had a negative impact across all AORs.

- On several occasions a query of current vessel position returned multiple vessel positions, each with different metadata (time, cargo, flag) attached.

- Users noted a general inconsistency of the CMA vessel database between nodes within the same AOR. An analysis was performed on the commonality/consistency of track data held by the NAVCENT and PACFLT CMA systems within a 5 by 10 deg geographic region in the Indian Ocean. Although 97% of the tracks were held by both systems, significant track metadata differences were observed in 15% of the tracks, and track history data were only 51% common (77% common for tracks going from the NAVCENT AOR to the PACFLT AOR, and 29% common for tracks going in the other direction). Some track history data in one site's CMA were not in the other site's CMA.

- Users consistently cross referenced other data sources to validate query responses returned by CMA. The user had limited information on information feeds into CMA. The user's uncertainty in the completeness of the data affected confidence in the search results.

- The percentage of worldwide cargo data fed to CMA by Global Trader was not known. The percentage of worldwide cargo data available via Cargo Link was not known.

- The ability to monitor un-equated vessels using only ELINT data was not observed.

(2) *E-2 Collect. Will MDA Spiral-1 technologies enhance the collection capability of the global maritime domain?* (YELLOW)

- The lack of commonality between nodes made the aggregation of information difficult. MDA Spiral-1 did not contain a central repository of worldwide vessel movement data. Differences in node metadata required additional research on the part of the user, increasing the time required to perform a mission.

- The user had no knowledge of foreign-to-foreign cargo sharing agreements or the amount of cargo data actually available, which affected the ability to build and evaluate cargo queries.

- The TES System Operational Verification Testing (SOVT) indicated a successful file upload to the SEAPORT CAS. However, the afloat capability was not observed.

(3) *E-3 Fuse. Will MDA Spiral-1 increase the ability to fuse data from information gleaned across COCOM AORs, interagency domains, and across multiple security classification domains?* (GREEN)

- Spiral-1 tools increased the user's ability to fuse vessel, people, and cargo data from interagency sources but provided limited capability to fuse data across AORS and security classification domains. The user had a limited ability to view a composite track with all gathered information. The tools did not allow for user-defined pedigree rule sets.

- Users sometimes lost track of the original security classification of the information they wished to disseminate. This increased the likelihood of a security violation as a result of passing classified information on the wrong domain.

(4) *E-4 Analyze. Will MDA Spiral-1 enhance the warfighter's ability to accurately and timely analyze the global maritime domain picture?* (RED)

- The ability to capture and store baseline/normal maritime movement patterns was not observed. Spiral-1 tools did not alert users to deviations from normal route or behavior patterns.

- FASTC2AP accessed historical track data but did not capture and store baseline movement patterns. FASTC2AP provided basic anomalous detection capability based upon a user-defined agent using historical track, not baseline/normal behavior patterns.

- CMA track data was primarily limited to tracks within the AOR. Lack of track data outside the AOR limited the user's ability to analyze maritime movement patterns. Baps

in track and metadata also affected analysis of data within a node and affected the ability to collaborate between nodes.

- The MDA DS COI may provide a basic anomalous detection capability but since the users were not trained on the full capability it was not observed.

- Cargo Link did not provide a cargo anomaly detection capability.
-
- Spiral-1 did not provide new toolsets to enhance collaboration between nodes. Spiral-1 technologies did allow for the easy export of search response data for use with existing collaborative tools. The collaboration tool of choice was MS Chat. NCIS used the web-based Force Protection Portal for cross AOR collaboration. The portal acted as a central repository for all information concerning the investigative scenarios.

- Spiral-1 tools did not provide additional capability to establish baseline normal civil maritime operations worldwide and threat assessment criteria. CMA and FASTC2AP could alert based upon a geographic point/area/proximity, but did not support alerts employing algorithms based upon baseline maritime operations.

- Spiral-1 tools did not conduct statistical analysis of data gaps in order to identify potential new sources of information and drive new collections.

(5) E-5. *Disseminate/Collaborate. Will MDA Spiral-1 provide timely and accurate correlation, storage, and display of operational data and other tactically significant information in a manner that will support the full spectrum of global information needs?* (YELLOW)

- Spiral-1 did not automatically establish or display threat assignments based upon a user-defined alert.

- FASTC2AP alerted the user, per user-defined alerts, when a vessel meets the alert thresholds. The user then conducted a threat analysis on the vessel. The TAC system will alert the user that there is a data element that meets search criteria.

- MDA Spiral-1 was not a composite system and the ability to aggregate and replicate MDA data on a global scale was not possible. CMA did not replicate its database globally, each node maintained its own local database.

- MDA DS COI was observed at MIFCPAC and MIFCLANT only, therefore the global effectiveness and suitability of the technology cannot be assessed.

- The NAVCENT TAC system and Cargo Link were the only Spiral-1 technologies that had direct access to ONI historical maritime data. The SEAPORT CAS use was observed at NAVCENT only.

(6) *E-6 Operating Picture. Will MDA Spiral-1 enhance the user's ability to maintain an operational picture that supports access to tactical, operational, and strategic data elements across multiple AORs?* (YELLOW)

- Based on analysis of 4 hours of extracted data in a littoral area,
  - CMA and MDA DS COI vessel track data were 84% common.
  - CMA data were 93% common,
  - MDA DS COI were 81% common with track data provided via the legacy COP.
  - The MDA DS COI data were less common than the CMA data because of interruption in input data streams during part of the analyze period.
  - In other regions (open ocean) MDA DS COI picture was substantially less complete than CMA due to lack of classified inputs.
  - In a littoral region, CMA data latency was 127 min on average compared with 24 min for the legacy COP and 40 min for MDA DS COI.
  - CMA track data latency was substantially larger in an open-ocean area: 11.1 hrs on average for the analyzed sample of tracks in the Indian Ocean.
  - Because of the CMA data latency, the current positions of CMA tacks lag the positions held in the legacy COP. The capability to transfer track data from CMA to the legacy DOP was demonstrated; but doing so resulted in a redundant track when the legacy COP already held the contact. The legacy system does not correlate/fuse data input from CMA.

(7) E-7 *Communication Capacity. Can existing communications paths support added MDA Spiral-1 communications requirements?* (GREEN)
- Although not a specific tasking, the communication capacity required by MDA Spiral-1 was assessed only to make a determination of the impact on future installations of the Spiral-1 capability. A degradation in capability was observed at on node due to bandwidth limitations while conducting multiple exercises. The node was required to timeshare bandwidth to accommodate each event. Communications capability should be considered if there are intentions to deploy these capabilities afloat or to a shore–based unit with limited capabilities.

C. SUITABILITY CRITICAL OPERATIONAL ISSUES

(1) *S-1 Reliability*. (GREEN)

- The Spiral-1 suite did not suffer any hardware or software operational mission failures. The MDA suite as a whole was operational during all FARIGAME exercise periods.

(2) *S-2 Maintainability*. (WHITE)

- The NMIC CMA system suffered an unknown failure that rendered it unusable. An attempt by NRL to troubleshoot via remote access was unsuccessful. A technician

arrived on-scene to conduct on-site troubleshooting and discovered a faulty hardware router and replaced it five hours later.

- A potential issue is that the primary means of troubleshooting a CMA problem is for NRL to access the local via remote web access. If the problem cannot be resolved remotely, NRL must dispatch a technician to the node. COMUSNAVCENT however, has a permanent SPAWAR Fleet Systems Engineering team representative onsite to resolve CMA hardware issues.

- The Spiral-1 suite did not suffer any hardware of software operational mission failures. The MDA suite as a whole was operational during all FAIRGAME exercise periods.

(3) *S-3 Availability*. (GREEN)

- The MDA suite was operational during all FAIRGAME exercise periods.

(4) *S-4 Logistics Supportability*. (GREEN)

- The MDA Spiral-1 integrated logistics support plan (ILSP) was reviewed. No issues were observed.

(5) S-5 Compatibility. (GREEN)

- No compatibility issues were observed.

(6) *S-6 Interoperability*. (GREEN)

- Some CMA client workstations using legacy Internet Explorer 6 could not operate CMA. CMA is designed to operate on Internet Explorer 7. The workaround was to use the Firefox web browser.

- CMA requires JAVA 1.6. Other host systems use legacy version JAVA 1.4. When CMA is loaded on the same hardware as GCCS-M, the JAVA 1.6 causes the local GCCS workstation to crash. The workaround is that CMA must be loaded on separate hardware.

- When using CME and Google Earth 4.2 simultaneously, system crashes resulted. Google Earth 4.2 had to be configured to use DIRECTX graphics setting instead of OpenGL graphics setting because the version of OpenGL installed on the CMA workstation causes Google Earth to crash.

(7) *S-7 Training*. (YELLOW)

- The post-installation training was generic in nature and not tailored to the individual site requirements/mission. User feedback indicated that the FAIRGAME scenario construct

provided a more realistic training environment because the scenarios allowed for more

real-world applications of the technologies. An official Navy training pipeline is not in place roe MDA Spiral-1.

(8) *S-8 Human Factors*. (GREEN)

- Because MDA Spiral-1 was not a composite system, users were required to switch between windows and classification domains multiple times, causing them, at times, to become confused as to which domain they were looking at. The confusion caused users to lose track of the original security classification of the information they wished to disseminate.

(9) *S-9 Safety*. (GREEN)

- No safety issues were observed.

(10) *S-10 Documentation.* (YELLOW)

- Current Standard Operating Procedures (SOP) and TTP do not address the new MDA Spiral-1 tools. OPNAV N3/N5 has developed an outstanding draft MDA SOP that, with further refinement and extensive Fleet feedback will provide the groundwork for all MDA nodes to employ the new technologies to their fullest extent. The SOP in its current version will assist the users in navigating through the different technologies, but requires feedback.

- Beyond the tasking provided by the White Cell, the users did not know why or when to use a specific technology to produce an expected results. Users required prompting by the White Cell, and observers, to think outside of the box when looking for specific information.

- Users were unaware of technology manuals and the Online Learning Development (OLLD). The draft online learning compact disc was made available to the nodes no earlier than two days before the start of FAIRGAME. The draft version of the OLLD is sufficient to provide the user with a baseline buttonology level of knowledge. The finalized version of the OLLD is expected to be made available via web services sometime in August 2008.

D. OPERATIONAL CONSIDERATIONS FOR LEAVE BEHIND TECHNOLOGIES

(1) CARGO LINK.

- During Trident Warrior Cargo Link performed very well during scripted scenarios facilitated by the Subject Matter Expert (SME). Most queries found the expected results on the first attempt.

- During FAIRGAME, cargo searches at one node did not produce a successful query result during the entire event, likely due to insufficient user training.

- Cargo Link contained only six months worth of data. Searches beyond six months require a request to the NMIC Global Trader office.

- Cargo data was observed in CMA but not on all vessels.

- The scope of partner nations with cargo sharing agreements is not known.

- Cargo Link is still a developmental system that will not become operational until 20 Aug 2008.

(2) CMA.

- During FAIRGAME, CMA was often the technology of choice when starting a search. Many of the FAIRGAME users had experience in previous Operational Demonstrations (OD) as well as in Trident Warrior and noted that system information reliability continued to be a concern.

- Users doubted the completeness of the CMA database and used other systems to validate the CMA search result. It is unclear to the user what data is actually feeding CMA; users noted the need for comparable data as available with the legacy systems.

- Pre-defined alerts were not representative of current operational needs. CMA is not capable of providing user-defined alerts.

- Single vessel searches sometimes resulted in multiple tracks, each with different information attached. Analysis concluded that some of the search results were inactive tracks.

- Advance searches were not intuitive.

- Each node maintains its own CMA database with no two nodes having the same information. For example, the MIFCPAC CMA database contained information not available to the PACFLT database.

- During the casualty to the NMIC CMA server, users noted excessive search lag times when conducting queries.

- At times CMA would exhibit an ERROR 500 message which required the user to exit the web browser and sign back in.

- Although the data reliability issue cited by users remains a concern, CMA is still a capable system and greatly enhances the warfighter's ability to maintain situational awareness.

(3) FASTC2AP.

- User feedback indicated FASTC2AP on SIPRNET would be more useful/capable with additional GENSER track history feeds not available on CENTRIX.

- A geospatial option would allow greater situational awareness and agent building.

- FASTC2AP provides a basic user-defined anomalous detection capability.

(4) GOOGLE EARTH FUSION SERVICES.

- Google Earth fusion services provided some utility but was viewed as redundant.

- Users used Google Earth to display vessels of interest by downloading KML files from the legacy SEAWATCH database.

- Google Earth fusion services 4.2 was not observed on the PACFLT NMCI SIPR LAN, the intended network, but was installed and observed on CENTRIX.

(5) LINX.

- User feedback indicates limited training prior to Trident Warrior.

- Other than the collaboration tools, the system was viewed as redundant and time consuming.

- The full potential use of the system requires a shift in current NCIS investigative processes.

- Users did see utility in the Force Protection Portal for viewing historical incident data and for its collaborative ability.

(6) MAGNET.

- Information from a stand-alone MAGNET system was not available due to sharing agreements concerning U.S. person's information.

- Vessel information provided by MAGNET was observed via CMA, if it was available.

(7) MDA DS COI.

- During Trident Warrior the demonstrations were facilitated by the TW MDA Focus Area lead.

- FAIRGAME user feedback indicated a limited utility that might be accessed more as an afterthought or when all other systems had been exhausted.

- Anomalous behavior detection capabilities were not observed.

(8) SEAPORT.

- SOVT was not complete prior to the end of FAIRGAME events.

- Test data upload into SEAPORT was not observed, however, SPAWAR SOVT results indicate a successful transfer of an imagery file from the TES to SEAPORT.

(9) SMS/JPSC2.

- SMS data was observed in the MDA DS COI.

(10) TAC.

- The TAC system was the technology of choice for users who were experienced with the capabilities it provides.

- Contextual information on vessels of interest and persons of interest is outstanding.

- One major limitation noted was the range of historical information available. Users indicated that data currently available does encompass the full DIA historical database.

- Users also noted that certain information is stripped from the database before it reaches the user, but what is stripped is unknown.

(11) TES.

- The TES demonstration was conducted per the developer test plan in conjunction with a U.S. Navy VBSS graduation scenario pierside onboard the USS MOUNT RUSHMORE (LSD 47). Additional developer end-to-end testing was conducted at COMUSNAVCENT ICW SOVT.

10.7 Findings

MDA Spiral-1 is determined to be potentially operationally effective and potentially operationally suitable.

The leave-behind technologies will enhance the warfighter's ability in maintaining situational awareness of the global maritime domain.

Current MDA training and documentation provide the basic building blocks to employ the Spiral-1 suite.

Additionally, the warfighter's ability to locate, track, an pass information to other MDA nodes is enhanced.

10.8 Recommendations

A. OPNAV consider implementing Predictive Analysis for Naval Deployment Activity (PANDA) and Maritime Auto Super Track Enhance Reporting (MASTER) as MDA capabilities. Although not Spiral-1 technologies, the OTA did observe both demonstrations during Trident Warrior, and while still in the developmental stage, both technologies demonstrated utility in filling capability gaps in regards to vessel tracking and capturing/storing maritime baseline movement patterns in order to provide anomalous detection.

B. OPNAV resolve information sharing agreements concerning U.S. persons.

C. OPNAV convene an MDA users working group, to include coalition participation, to refine MDA documentation requirements.

D. OPNAV implement a dedicated MDA course of instruction of include it in existing NTSPS.

E. NCIS continue to refine CNIC MDA CONOPS and conduct additional law enforcement exercises using real-world data to educate agents on the full capabilities of LINX.

F. PEO C4I consider deploying FASTC2AP on SIPRNET and expanding the capability to other nodes.

G. PEO C4I track estimated Cargo Link operational date and node user account set-up.

H. PEO C4I conduct additional advanced training in an operational setting using real-world data is required to maximize capability utility.

I. PEO C4I investigate and resolve the cause of Google Earth 4.2 installation issues at COMPACFLT.

J. PEO C4I finalize OLLD and make it available via web access.

K. PEO C4I improve human-system integration in conjunction with development of follow-on spirals.

L. PEO C4I allows adequate time between installation and future assessment events to allow users to become proficient at using the new tools.

M. NRL investigate the CMA IE7/Firefox web browser and JAVA 1.4/1.6 issue.

10.9 Caveat

This QRA presents primarily statements of opinion and not findings of fact. Operational Test and Evaluation is required to substantiate the results of this assessment.

10.10 FAIRGAME Survey Results

Special surveys for FAIRGAME operators have been are being executed. The results will be available at a later time and presented in a subsequent version of this report.

D.3 White-Cell Logs and Chat Results

White-Cell chat logs are classified and cannot be included in this report. Non-classified results have been extracted and are presented in Sections 5 through 8.

11.0 Appendix E: Technical Risk Reduction Limited Objective Experiment Results

TRRLOE was a risk reduction limited objective experiment for FAIRGAME. It executed the FAIRGAME defined events, although without the full suite of Spiral-1 systems. It was conducted in a laboratory environment rather than at operating centers. The experiment was carried out in Lab 140, SSC, San Diego.

Three users participated in the TRRLOE; two participants used the CMA technology and one used FASTC2AP and Google Earth systems throughout the experiment. Participants included an IS-3 Strike Analyst, an IS-2 Optical Analyst, and a LT Intelligence Analyst, currently attending the Naval Postgraduate School. The average service time for the participants was about five years and their level of experience in their current positions ranged between intermediate and advanced.

These results are based on extractions of data from:

- Observer logs
- Hot-wash-ups that were conducted with all personnel at the end of each day
- Surveys that were completed by the operators

The following results are summaries obtained directly from the data sources, prior to detailed analysis.

11.1 Observer Log Results

The following results are for CMA, except where noted.

Information Acquisition Times – Even though the systems were not used in an operational environment, the amount of time required to obtain information using them was representative. Very little time was required. E.g.,

- 1 min to determine when ship was built after White Cell request.
- 7 min to determine person-of-interest was not on reported ship.
- 2 min to identify cargo on a named ship.
- 10 min to locate a ship and identify its origin and arrival locations.
- 6 min to locate a ship, details on type and crew.

It is possible that these times are biased to shorter time because historical data was used for which the needed data was known to be present. Even so, these information acquisition times represent an improvement over existing procedures.

Operator Performance/Training – Operator training on the operations they were asked to perform with the systems was minimal. Within this context, the following observations can be made:

- They developed facility with the systems in a short period of time, usually after about ½ hour of working with a functionality.
- How the system applied to, or could be used for, the jobs with which they were familiar was clear. Difficulties they had were largely the result of system malfunction (due to lab environment).
- There were instances where an operator searched for a function or capability CMA did not have. This could be a training issue and/or represent functionalities that should be added.
- It is clear that two or three days of focused training on the Spiral-1 suite will result in fully competent operators.

Human-System Interaction – Note that the following HSI observations are based on operators who were not fully trained on the systems. More complete, operationally-based, training would alleviate some of the difficulties encountered. These observations apply to CMA unless otherwise noted.

- The layout of advanced search is cumbersome (layout and search parameters disappear when new search parameters are entered).
- The search information used when initiating a search cannot be seen when scrolling down in the display. This can result in losing track of overall search context. Operators requested a horizontal rather than vertical layout of information.
- Having political and AOR boundaries would aid the operator in setting up search areas.
- Searching for and acquiring information can involve many information elements. It would be useful to have a pre-structured notepad where the operator could enter information already obtained and build an information picture.
- Operators tend to develop personalized methods for information searches. It would be useful to have a means for capturing operator searches for reuse. This would be especially useful for categories in advanced search.
- Add ‘cargo’ to pull down search menu.
- FASTC2AP: The structure of the format used for setting up alerts is unclear and difficult to use.
- FASTC2AP: Add capability to make a polygon, a common shape required to conduct a search in the real world.
- Add feature to specify a point and a specified radius to establish a search area.
- Add feature to be able to enter a coordinate and then be able to set up a search area around it.
- Need better color coding along left-hand side for icons; make meaning of color explicit.
- Need better understanding of what pre-built searches do; user thought they were going to provide different information.
- Need ability to save an area when drawing a box/polygon with a specific name.
- Change hyper-graph: provide more detailed information (e.g., vessel name) and make it easier to read information

- Include the ability to draw a line to be able to search any track crossing a line rather than a box.

System Performance – Most system problems encountered were due to the lab environment and do not qualify as Spiral-1 system results. The following results are inherent to the systems, not the lab environment. These results are derived from limited tests of the systems and have not been validated.

- Partial match did not work as anticipated when searching for a ship name.
- Operators could not zoom in and draw a small geographical box around a VOI.
- Advanced search is difficult to use. Specifications can be lost when adding to search.
- Basic and advanced search need more defined categories, such as "hazmat" for cargo.
- It would be advantageous to be able to use distances when setting up searches.
- FASTC2AP: Three of the alerts (Course Proximity, Vessel Proximity, and Next Waypoint Feasible, require the SCONUM. Matching of ship name, position and SCONUM becomes classified. Since FASTC2AP will be fielded on CENTRIX, perhaps the ship's Lloyd's or International Maritime Organization (IMO) number could be substituted for the currently required SCONUM.
- FASTC2AP: Boolean criteria alerts were difficult to set up and all conditions may not be available.
- FASTCAP: Needs capability to refine searches more by user: current searches are too broad.
- FASTCAP: Understanding the results of agents was difficult
- FASTCAP: Could not designate an agent to find ships that came within 200nm proximity of the west coast.
- FASTCAP: Flexible template relations were difficult to understand.
- FASTCAP: Interface was not intuitive to use.
- Need separate category to rate the age of the data – an important criteria on which operational tasking is built on. (There is a quality rating, but time lateness of data should be a separate category.)
- Make the factors that go into "quality" rating transparent to the user.
- Need a clear indicator to inform user when any database is down.
- GOOGLE EARTH: Latest position was easy to get, but the Volpe AIS data was limited and not useful for in-depth analysis.
- GOOGLE EARTH: Could search for the latest position, but not for track data.

11.2 Survey Results

Surveys were administered for each of the technologies involved in the TRRLOE in addition to demographics and training surveys. System specific survey questions were developed in addition to the general survey questions that appear in all three surveys. Surveys used for TRRLOE MDA technologies are included in Appendix A. The purpose of the surveys was to gather feedback from the users involved in the exercise to identify strengths and weaknesses of the MDA

technologies. Topics included training effectiveness, system usability, suggestions for improvement, and features participants found particularly useful.

Baseline Training Survey Results

All three system operators had no prior knowledge of Comprehensive Maritime Awareness (CMA) or FASTC2AP technologies, or their capabilities, prior to the training. All users received an instructional brief, and depending on the participant, some received hands-on training, a quick reference guide, and trainer interaction. Two users felt that the training materials were easy to understand given the amount of time allowed to complete the tasking, and the other felt that the material was not easy to sift through. Participants thought the preparation, instruction, and training provided during TRRLOE for CMA and FASTC2AP was fairly productive, all users felt that there should have been more time allotted in order to adequately understand the processes and systems as a whole, in addition to working one-on-one with subject matter experts.

Regarding Google Earth, all users had prior knowledge of its capabilities. All users thought the instructional briefs and on-line tutorials were easy to understand and also agreed the training and instruction received prepared them for the tasks performed during TRRLOE.

Comprehensive Maritime Awareness (CMA)

Regarding the training materials provided, one user felt that for the limited time allotted, the materials made it fairly easy to complete the tasking while the other user felt that the training materials were not easy enough to navigate through and suggested an online version to improve the method of searching. One participant felt strongly about allowing more time during the exercise in order to adequately comprehend the material, while the other user's concern was to provide more one-on-one time with operators and subject-matter experts. One participant suggested that the system should have been fully developed beforehand to enable the participants to know what to focus on during the training and get the most out of the exercise along with more scenarios in order to practice on prior to the test evaluations. Although complications were experienced during the exercise, overall, the users felt satisfied with the training they received.

FASTC2AP

The FASTC2AP operator had approximately one hour of training on the system prior to the exercise, where he was first introduced to the technology. Two operators received training on the system in the form of an instructional brief which they both agreed was easy to understand. Participants agreed the training was effective, but it could have been longer, and suggested that more scenarios be added to the exercise in order to practice more before evaluations, and also requested more one-on-one time with operators.

Change Alerts so SCONUM is Not Required. FASTC2AP has a number of pre-defined alert functions. Their use requires an ONI-assigned SCONUM, which when combined with a ship's name and its position becomes classified. The SCONUM also may not be available to coalition forces. This makes these alerts of limited use and could cause future security concerns. It is recommended that the alerts be rewritten to require ship names only or the Lloyd's identification number.

GOOGLE EARTH

For the Google Earth application, all system operators had prior knowledge of the technology. Participants received an on-line tutorial in addition to an instructional briefing that they felt was easy to understand and use; the training was adequate for them to effectively utilize the technology. Due to the familiarity of the application, the users were satisfied with the training they received and felt that they could use Google Earth's technology effectively by the end of the exercise.

Comprehensive Maritime Awareness (CMA) Survey

Usability. Both CMA operators thought the technology was easy to learn and use, and the training produced basic knowledge of the system and its background. Both CMA users strongly agreed it was easy to develop and maintain situation awareness on a vessel of interest (VOI), especially once provided with a watch list that includes the names of the vessels. CMA operators emphasized that it was extremely easy to find relevant information on a VOI as long as one knew the name of the vessel; otherwise it would be difficult due to the hyper graph.

It was easy for CMA users to associate tipper/ Intel information with the correct VOI. CMA showed recent alerts on the vessel and made it easy to see the tippers. Operators maintained contact with the white cell (representing higher command) on chat. On day one, users found it difficult to cross reference tracks being used by operators on other systems due to the difficulty of looking at two units and not being able to compare them. However, on day two, CMA users agreed that the use of either FASTC2AP or Google Earth made it much easier to cross reference and pull up the necessary information to collaborate.

Suggestions for Improvement and Useful Features. Both CMA users experienced difficulties using the alerting system as well as the hyper graph. Participants noted that when searching on CMA using a partial search, the system did not always pull up all tracks containing a portion of the name. One user recommended adding a feature to provide the capability to use range and bearing from a point in a circle to form a search area. This user also suggested including the ability to use a line or border to search for any track crossing a line rather than a box as is done in the current system.

Another user noted that when attempting to save a box or area, the program would not warn the user when an existing file had the same file name, causing confusion when referring back to a basic search in the pull down menu, and finding two files with the same name. The user also suggested that the system should include a search pull down in the metadata section that allows for the search of cargo, making it easier to narrow down the hits. CMA users stated that the scenarios were realistic enough, and foresee the CMA system becoming a very useful tool for all AORs once incorporated. Participants thought conducting analysis on a VOI was easier and much faster when using CMA than with their previous system.

FASTC2AP

Usability. The participant felt that the program was difficult to learn resulting in the user having to try the agents multiple times in order to understand what each was providing in the way of results. On the second day the FASTC2AP operator stated it was fairly easy to create agents, however understanding the results was still difficult. This user was not able to utilize the online aid, nor did he know what the software "wizards" were. The FASTC2AP operator thought it was easy to compose agents, although the system could not provide the details required for some of the RFIs. This user found it very useful to build alerts in order to fill RFIs through the FASTC2AP alerting system. Since this exercise only looked at snapshot type problems, it was hard to maintain situation awareness on a VOI given that they did not track a VOI over a period of time. When collaborating with other operators during the scenario, the operator was able to cross reference some tracks, however CMA and FASTC2AP had access to different data, making it somewhat difficult.

Suggestions for Improvement and Useful Features. At one point this user wanted to find ships that came within 200 NM proximity of the west coast, and he was not able to designate an agent to carry out the task, suggesting that this capability should be added. This user also added that the flexible template's relations were difficult to understand and suggested that the graphical user interface (GUI) be made more intuitive. Lastly, this participant suggested removing the ship control number as a required field when using it on an unclassified network. Overall, the user viewed FASTC2AP as an effective VOI analysis tool with the correct data to support it.

GOOGLE EARTH

Usability. The user felt that this application was easy to learn, and use, finding no difficulty in using all of the features included in Google Earth. This user stated the system was a quick geospatial reference for developing awareness on a VOI as well as finding information on them. Conducting analysis on a VOI was easy, specifically for acquiring their last position; however the VOLPE AIS data was limited, and not useful for in-depth analysis or for providing tracking data. There was no embedded collaboration tool included, thus it was not possible to send information from Google Earth to other systems. However it was possible to look up vessels in other systems making it easier to cross reference tracks and information on VOI with other operators.

Suggestions for Improvement and Useful Features. The user found it useful as a platform for displaying data and not as a collaboration tool. Other than the missing information due to the difference in databases and the restrictions of the application, the user found the system to be very helpful throughout the exercise. The feature this participant found most helpful was the "find" option, providing an easy way to see if a VOI was in the data feed as well as finding basic information on the VOI.

12.0 Appendix F : Empire Challenge 2008 (EC08) Results

Empire Challenge is a yearly ISR experiment sponsored by NGA and JFCOM. Although it did not perform dedicated, MDA events, there were three MDA related events:

- Land-based biometric collection, and
- Sea-based biometric collection.
- Vessel tracking with a P3,

Information extracted from the first two events is reported here, not a complete description of the events to avoid superfluous discussion..

12.1 Land-Based Biometric Collection

China Lake biometric collections events were conducted on July 23 and 29. For each date, latent prints were collected from an Opposing Force (OPFOR) vehicle and a full spectrum of biometric collections was performed on a subject located in a cave.

Latent Prints

Initial collections were made after an OPFOR vehicle was engaged and disabled. The steps in the collection and analysis process were:

- Two prints collected from the vehicle were digitized with a ScanShell 1000 scanner.
- The Remote Latent Submission laptop embedded the digitized prints in Electronic Biometric Transmission Specification (EBTS) messages using the Videntity Latent Alchemist application.
- The biometric files were transferred to a laptop on the Battlespace Awareness ISR Integration Capability (JBAIIC) vehicle via flash drive.
- The files were transmitted to the Biometric Fusion Center (BFC) via the China Lake Community Of Interest (COI) network, the Joint Mission Support Module (JMSM), and the Tactical Network Topology (TNT) network.
- BFC conducted the match assessment and placed the report on the Video Conference tool #1(VC1) file repository.

Cave Collection

The biometric collection inside the cave was carried out as follows:

- Collection was with the Crossmatch SeekID collection device.
- The enrollment consisted of 10 finger prints, two iris images and one facial image.
- The biometric files were transmitted from the SeekID device in the interior of the cave to the JBAIIC vehicle parked just outside the cave by a sequence of three Cheetah radios.
- The messages were then passed over the COI network to the JMSM and from there over the TNT network to the BFC.
- The BFC developed a report (match/no-match) on the biometric collection which they published to a File Transfer Protocol (FTP) site.

- The Office of Naval Intelligence (ONI) did not participate in the cave biometric collection scenario, therefore the BFC provided the tasking (detain/ release) response to the biometric team.

Biometrics in the Common Tactical Picture (CTP)

The BFC generated Cursor on target (CoT) messages for the collection/enrollment, identification (match/no-match), and tasking (detain/ release) biometric events. The procedure to provide CTP information was:

- The CoT messages were sent from the BFC via TNT to the JMSM TNT node where they were pushed through a firewall to the COI unclassified network.
- The display of these events in the CTP requires that the location of the event be included in the message.
- There were no positions provided with the latent print messages and for the cave collection, there was no SeekID Global Positioning System (GPS) reception and therefore no position was included in the biometric messages.
- Accordingly, the BFC manually entered into the CoT messages the position reported to them over VC1 chat.
- The CoT messages were disseminated by the COI CoT server and successfully displayed in the COI CTP, passed through the Raytheon High Speed Guard (RHSG), and displayed in the CFE CTP.

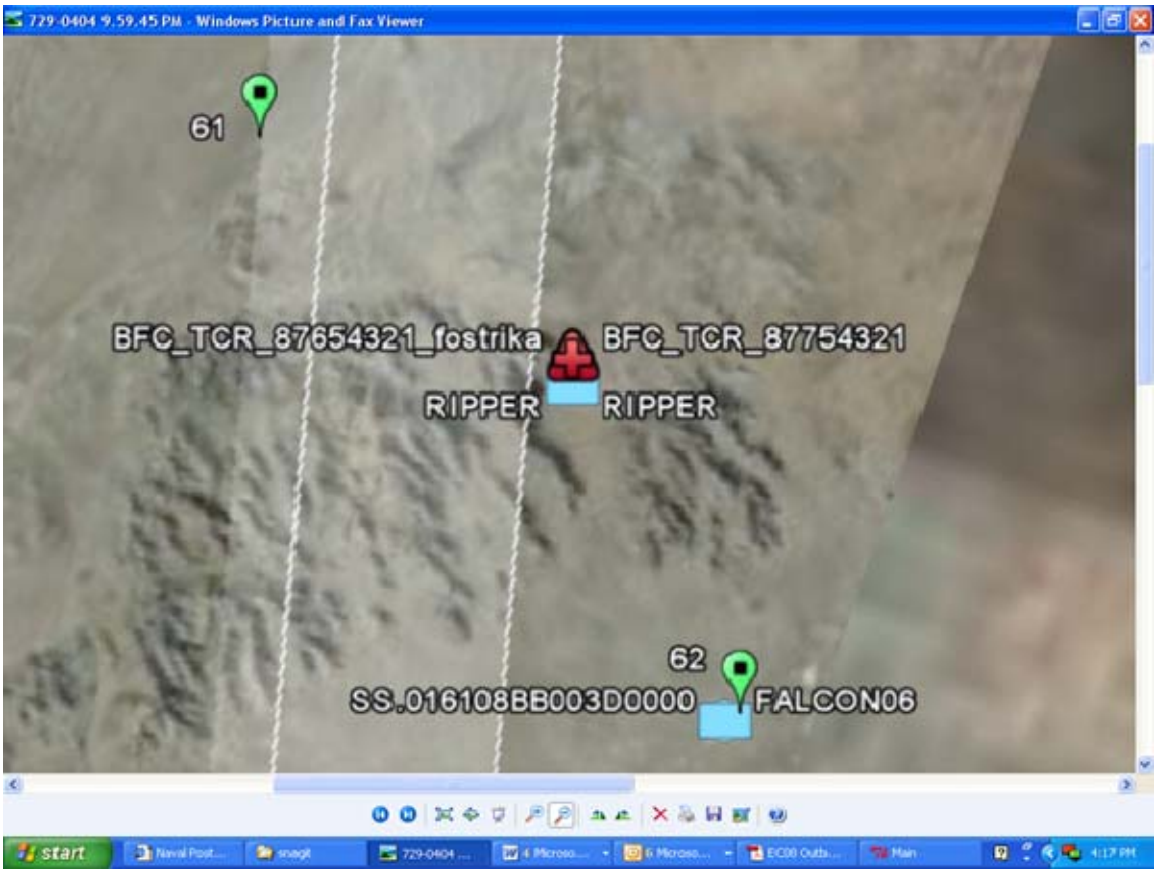


Figure 7. COI CTP Screen Capture of Biometrics Events

This Google Earth screen capture shows Ripper, the JBAIIC vehicle, whose position was provided by the PRC-117G radio, in the vicinity of the cave. The red, cross icon represents the biometric CoT tasking event. It is superposed on a red triangle icon that denotes the biometric CoT identification event**.** Falcon06 is the JMSM location.

Findings

- The China Lake biometric events were fundamentally successful. The prime objective of the EC08 EMIO event was to demonstrate transfer of appropriate data between the various participating nodes. Speed of execution was not a primary concern.

- During the cave biometric collections communication to the BFC were lost or slow primarily as a result of communication unreliability between the JBAIIC vehicle and the Slate Ridge antenna. During the July 29 latent print collection, a router failure delayed transmission of the print files to the BFC.

- The biometric coordinator in the JMSM at China Lake had adequate Situation Awareness (SA) of the biometric collection and assessment process through VC1 chat. Video added little in part because of the problematic communication link.

- A protocol needed to be defined for where the biometric collections are to be posted and to where BFC results are to be disseminated.

Assessment of EC08 China Lake Biometric Events Objectives

Listed below are the JBAIIC EC08 objective questions that relate to the China Lake biometric events and an assessment of the degree to which the objectives were satisfied.

Q-1: Can biometric collection messages be transmitted from the interior of a cave to the BFC and JMSM? (Partially Satisfied)

Biometric collection messages were successfully transmitted via Cheetah radios, the COI network, and the TNT network from the interior of the cave in the vicinity of CP 82 located west of China Lake Echo range to the BFC. These communications were not consistent because of a marginal radio link between the vicinity of the cave and Slate Ridge

Unlike the EMIO demonstration, the biometric files were not posted to the VC1 File Repository so that the collections were not accessible to the biometric coordinator in the JMSM.

Q-2: Can biometric match/no match messages be transmitted from the BFC to the cave biometric collection party in the interior of the cave and the JMSM? (Fully Satisfied)

The match/no-match messages from the BFC were posted to the VC1 File repository and/or VC1 chat where they were accessible to the collection party and the biometric coordinator at the JMSM.

Q-3: Can biometric detain messages be transmitted from ONI/NMIC to the cave biometric collection party in the interior of the cave and the JMSM? (No Test)

ONI did not participate in the China Lake biometric events. BFC developed the detain messages which were communicated only as CoT messages to the JBAIIC CTP.

Q-4: Were the biometric collection, match/no-match, and detain events displayed in the CTP? (Fully Satisfied)

Biometric CoT messages were developed by the BFC and sent via TNT to the CFMCC TNT node in the JMSM where they were automatically pushed through a firewall to the COI network. The CoT messages were disseminated by the COI CoT server and successfully displayed in the COI CTP, passed through the RHSG, and displayed in the CFE CTP. For the July 29 cave biometric event all three biometric CoT messages were displayed in the CTP.

Q-5: Did the tools provided to the CFMCC in the JMSM provide adequate SA to exercise effective C2 of biometric events? (Fully Satisfied)

The CFMCC/biometric coordinator in the JMSM at China Lake had adequate SA of the biometric collection and assessment process primarily through VC1 chat. Video added little because of the very low update rate.

12.2 Sea-Based Biometric Collection

The EMIO biometric collection was conducted aboard the Liberty ship Jeremiah O'Brien located in San Francisco Bay on July 18, 2008.

EMIO Biometric Data Capture
The Biometric collections (enrollments) were performed on three subjects in the interior of the Liberty ship (aft steering room) using

- Crossmatch Jump Kit collection devices for enrollment. The Jump Kit included:
  - Panasonic Toughbook,
  - Guardian R Fingerprint Capture Device,
  - I Scan Iris Capture Device,
  - Cannon A640 Digital Camera, and
  - Mission Oriented Biometric Software (MOBS) V1.3.3 software.

The enrollment included:

- demographics,
- iris image capture (both eyes),
- 10 fingerprints, and
- full facial image.

Biometric Data Sharing
Data and information sharing were as follows:

- Biometric collections were passed as Electronic File Transmission (EFT) files to a File Transfer Protocol (FTP) site at the Biometric Fusion Center (BFC).
- Data were processed with the Validation And Match Tool (VAMT).
- Match results were passed from the BFC to the boarding party via FTP, to the CFMCC via chat, and to the Office of Naval Intelligence (ONI) via e-mail.
- The BFC fusion center generated Cursor on Target (CoT) messages for the biometric events for display in the JBAIIC Common Tactical Picture (CTP).
- ONI generated a quick look report, Biometric Intelligence Analysis Reports (BIAR) and modified BIARs, which were passed to the CFMCC via e-mail.
- The CFMCC forwarded the ONI quick look report to the Boarding Officer (BO) via chat.

Communications

- Cheetah radios were used for the transmission of data between the interior and the Network Operations Center (NOC) of the ship on which the collection took place.
- A sequence of six Cheetah radios was used to transfer communications between the interior and the NOC (wardroom) of the ship.
- From the NOC, the communications flowed through a hardwire link to a Tactical Network Topology (TNT) node radio above deck on the ship. The TNT network included nodes at:
    - Jeremiah O'Brian
    - NPS TOC/NOC
    - CFMCC
    - BFC

ONI was not on the TNT network and communications between ONI the BFC and the CFMCC were primarily by internet e-mail.

Collaboration: CV1, a collaborative application developed at NPS, was the principal tool used for collaboration in the EMIO collection demonstration. CV1 rode on the TNT Virtual Private Network (VPN). The nodes listed in the following table participated in VC1 chat.

Node	Location
CFMCC	JMSM 2, China Lake
NPS NOC	NPS, Monterey
SS Liberty	Jeremiah O'Brien, TOC/NOC. Ward room
Boarding Officer	Jeremiah O'Brien, armory, site of biometric collection
biocollect	Jeremiah O'Brien, armory, site of biometric collection
BFC	Clarksburg, West Virginia

Video: Video was available over VC1. The only video source was from the engine room of the Liberty ship. The video reached VC1 via cell phone not the Cheetah radios. The video was sporadic and of limited usefulness.

File Repository: The File Repository feature of VC1 allows users to place files in a repository where they can be retrieved by other user.

Biometrics in the Common Tactical Picture (CTP)

The BFC generated CoT messages for and the match/no-match events (CoT event type b-a). The intent was also to develop CoT messages for the collection/enrollment and the ONI tasking (detain, not detain) events but this was not realized in the EMIO event.

- The CoT messages were sent via TNT to the CFMCC TNT node in the JMSM where they were manually pushed through a firewall to the China Lake Community Of Interest (COI) unclassified network.
- The display of these events in the CTP requires that the location of the event be included in the EFT message. Because the collection occurred below decks in the Jeremiah

O'Brien there was no Global Positioning System (GPS) reception and the Crossmatch GPS provided no location.
- The coordinates were provided in VC1 chat to the BFC and manually inserted into the CoT messages.
- The CoT messages were disseminated by the COI CoT server and successfully displayed in the COI CTP, passed through the Raytheon High Speed Guard (RHSG), and displayed in the CFE CTP.

Findings

- The EMIO biometric event was successful. The communications functioned essentially as planned. The use of six Cheetah radios to relay communication to and from the interior of the ship was cumbersome. Fewer radios may have successfully performed the task but this was not tested. The prime objective of the EC08 EMIO event was to demonstrate transfer of appropriate data between the various participating nodes. Speed of execution was not a primary concern.

- The CFMCC at China Lake had adequate Situation Awareness (SA) of the biometric collection and assessment process primarily through VC1 chat and e-mail. Video added little because of the very low update rate and presented content (engine room). Audio over VC1 should be explored.

- The sending of the biometric data from both BFC and CFMCC to ONI was redundant.

- The CoT messages provided to the CTP require amplifying data and only one of the three planned event types was sent, but the basic objective of displaying biometric information in the COI and CFE CTP was successful.

- When GPS data are not currently available, Crossmatch should default to the last good GPS position to insert in the EFT collection message.

Assessment of EC08 EMIO Objectives

Listed below are the JBAIIC EC08 objective questions that relate to the EMIO event and an assessment of the degree to which the objectives were satisfied.

Q-1: Can biometric collection messages be transmitted from the interior of a ship to the BFC and JMSM2? (Fully Satisfied)

The EFT formatted biometric collection messages were successfully transmitted via Cheetah radios and the TNT network from the interior of the Jeremiah O'Brien in San Francisco to the BFC. The biometric collection messages were posted to the VC1 File Repository by the collection team where they were accessible to the CFMCC in the JMSM2 at China Lake. The CFMCC did not have the software required to open EFT files.

Q-2: Can biometric match/no-match messages be transmitted from the BFC to the boarding party in the interior of the ship and the JMSM2? (Fully Satisfied)

The match/no-match messages from the BFC were posted to the VC1 File repository where they were accessible to the boarding team and the CFMCC at JMSM2. The match/no match results were also reported by the BFC in VC1 chat.

Q-3: Can biometric detain messages be transmitted from ONI/NMIC to the boarding party in the interior of the ship and the JMSM2? (Fully Satisfied)

ONI assessment messages were passed to the CFMCC in JMSM2 via internet e-mail. The assessments were passed by the CFMCC to the boarding team via VC1 chat.

Q-4: Were the biometric collection, match/no-match, and detain events displayed in the CTP? (Partially Satisfied)

Biometric CoT messages were developed by the BFC and sent via TNT to the CFMCC TNT node in the JMSM where they were manually pushed through a firewall to the COI network The CoT messages were disseminated by the COI CoT server and successfully displayed in the COI CTP, passed through the RHSG, and displayed in the CFE CTP. Only the ID (match/no-match) CoT messages were developed for the EMIO event.

Q-5: Did the tools provided to the CFMCC in the JMSM provide adequate SA to exercise effective C2 of biometric events? (Fully Satisfied)

The CFMCC in the JMSM at China Lake had adequate SA of the biometric collection and assessment process primarily through VC1 chat and internet e-mail. Video added little because of the very low update rate and presented content (engine room).

Lessons Learned

- The CM Jump Kit with MOBS V1.3.3 proved intuitive. The operator had 15 minutes of training. His time capturing a full enrollment decreased with each enrollment. By his third enrollment, he required no assistance.
- The Scanshell scanner is not plug-n-play. The scanner had to be configured at site. The BFC TASC branch has performed limited testing on the Scanshell.
- The Cross Match SeekID and the Cheetah radios are prototype systems and performed well during this first operational use.
- The file from the Cross Match SeekID was rejected at the BFC due to incomplete enrollment procedures during the practice day at China Lake. During the actual MDA day, the Seek-ID files transmitted to the BFC from the cave were at 100% integrity and accepted by the BFC database.

- Standards and guidelines should be established for the BFC's VAMT to promote procedural commonality and foster interoperability. The tool should undergo a complete independent verification, validation and accreditation according to DoD Instruction 5000.62.

13.0 Appendix G: Trident Warrior 2008 (TW08) Results

Trident Warrior (TW) is a yearly Navy operational experiment that focuses on Net-Centric applications. TW08 included an MDA Focus Area. Tables G1 contain each of the MDA objectives and measures. Following the tables are the results for each of the objectives.

Each of the TW experiments has a set of Focus Area, with MDA being one for TW08. Each Focus Area has a set of experimentation Objectives. Experiment Threads are sets of questions, associated metrics, data capture, scenarios, etc. The table contains each of the MDA Objectives, their associated Questions to be answered, and the Measures and Surveys that produce the information to answer the Questions. Results are the Context under which the information was gathered, Question answer, and the impact of the context on the result.

Table 18. TW08 MDA Experiment Threads objectives and results.

Thread #	MDA-01.01
Objective	Enable effective maritime domain awareness and analysis among distributed partners.
Question	Does CMA create an accessible, accurate and usable user-defined operational picture in the maritime environment, utilizing multiple data sources from multiple security levels?
Measures	Which Chat used. Awareness accuracy.
Surveys	Accessible, Accurate and Usable
Context	
Quest Ans	**Accessible**: Yes, CMA is accessible. Users reported being able to access data and that it reduced their current workload. **Accurate**: Yes, 90% of users either agreed or strongly agreed that they could maintain awareness of maritime activity through CMA. **Usable**: Yes, Users were able to easily create watch areas and do what they need to do for a mission. It should be noted that many users reported "N/A" with regard to ease of create briefing materials and methods for creating watch areas.
Cntxt Imp	

Thread #	MDA-01.02
Objective	Enable effective maritime domain awareness and analysis among distributed partners.
Question	Does CMA facilitate the reliable and timely analysis of maritime information via information exchange and analytic tools?
Measures	Timely, relates to the planning or decision-making process, dependent on ship's location and intentions.
Surveys	Reliable and Timely Use the JCTD instrument? Suffice for TW? Include on Web Surveyor?
Context	Observers were requested to make observations that would provide data to evaluate the reliability and timeliness of analytic information provided by CMA. Usage conditions did not permit observation data on reliability and timeliness to be gathered.

Quest Ans	Based on feedback from surveys, CMA assisted in facilitated the reliable and timely analysis of maritime information. With regards to reliability, users reported that it is important to be able to view underlying data provided by CMA in evaluating tracks. With regards to the timely attribute, users reported that being able to access data from one source (CMA) was faster than existing procedures. Users also stated that it made their job easier to be able to correlate and store information in a single system. Finally, 63% of users strongly agreed that response time was adequate.
Cntxt Imp	Data for assessment of this thread is restricted to survey data.

Thread #	MDA-01.03
Objective	Enable effective maritime domain awareness and analysis among distributed partners.
Question	Does CMA reliably and accurately detect when conditions of interest are met?
Measures	When algorithm detects COI. Detection accuracy.
Surveys	Reliable, Accurate, Relevant
Context	Observers were requested to make observations that would provide data to evaluate the reliability and accuracy of CMA's ability to provide reliable and accurate information regarding conditions of interest. Usage conditions did not permit data on reliability and accuracy to be gathered.
Quest Ans	Based on survey responses, CMA provides users with data that is relevant and helpful to their analysis of conditions of interest. No data regarding 'reliability' or 'accuracy' of the data was provided for assessment.
Cntxt Imp	A complete assessment of this thread could not be accomplished due to limited data.

Thread #	MDA-01.04
Objective	Enable effective maritime domain awareness and analysis among distributed partners.
Question	Does CMA provide the flexibility to use pre-defined conditions of interest and to create new, relevant conditions of interest in a timely manner, for the generation of alerts?
Measures	Logging of conditions of interest. Specify what system conditions are needed for correlation.
Surveys	Yes -- Flexible, Manageable, Relevant, Timely
Context	Observers were requested to make observations that would provide data to evaluate the degree to which CMA is flexible and manageable in the provision of relevant conditions for the generation of alerts. Usage conditions did not permit data on reliability and accuracy to be gathered.
Quest Ans	Yes, the majority of users reported liking the ability that CMA gives them to leave an alert in a vessel file that can be used by other analysts. Users also reported being able to rely on pre-defined alerts to stay informed about vessels of interest. Regarding the timely attribute, users reported that query functions saved significant time. Specifically, it was helpful to be able to filter by location, time, vessel name and vessel attributes.
Cntxt Imp	Data for assessment of this thread is restricted to survey data.

Thread #	MDA-02.01
Objective	Evaluate the capability to track vessels using National Technical Means and Open Source Data and provide operators with alerts as related to suspect vessels, cargo, personnel or MDA conditions of interest.
Question	Can vessels be tracked accurately utilizing the various feeds and sources in MASTER?

Measures	would like to gather BHR sniffer data (but JWICS) Network load -- bits per load increased with MASTER--the JTAA responsibility -- Persistence.
Surveys	Efficient, Any other non-ThreadEx uses suggested?
Context	
Quest Ans	*Survey Summary*: MASTER was considered to be an efficient vessel tracking tool using various feeds and sources, although respondents were divided on whether MASTER reduced their overall workload. Respondents agreed they could track vessels as needed, that MASTER is very useful for maritime analysis (especially the track analysis and plotting features) and that its capability to integrate multi-source intelligence and information with fused SuperTrack data is valuable. Respondents mostly agreed that MASTER's capability to automatically acquire data on vessels of interest is superior to current data acquisition processes. MASTER's track analysis and graphing capabilities were among its strengths, but its archive database was often slow to respond to queries. MASTER was easy to use when creating new vessel tracks. Its user interface could be improved by making the vessel of interest category more salient and improving the mapping program. *Observer Log Summary*: The vessel track information in MASTER was persistent. Tracks remained displayed until the operator cleared them. Some users questioned the completeness or accuracy of the information in MASTER's database and supplemented it with other sources of maritime information, such as SeaLink. Two users preferred ASA over MASTER because they judged it to be faster and easier to use, not because it is more accurate than MASTER Various usability issues were identified, especially with respect to querying MASTER's database and defining alerts.
Cntxt Imp	

Thread #	MDA-02.02
Objective	Evaluate the capability to track vessels using National Technical Means and Open Source Data and provide operators with alerts as related to suspect vessels, cargo, personnel or MDA conditions of interest.
Question	Are the Pre-defined alarms and alerts in MASTER reliable, trusted and accurate?
Measures	Accuracy with respect to alerts provided by MASTER.
Surveys	Reliable, Trusted & Accurate (assistance to MASTER for building instruments, responsibility for content is JTAA).
Context	
Quest Ans	Respondents agreed that MASTER's pre-defined alerting capabilities are better than current methods. They also agreed that they could count on MASTER's pre-defined alerts to detect conditions of interest. Respondents agreed that MASTER's pre-defined alerts are very useful for identification of potential maritime threats. MASTER can provide named data faster than current systems, such as GALE. Respondents were split on whether MASTER processes multiple-source intelligence faster than current methods. The main criticism of MASTER focused on its slowness, especially in response to database queries; current tools (GALE, Sealink) were described as being faster.
Cntxt Imp	

Thread #	MDA-02.03
Objective	Evaluate the capability to track vessels using National Technical Means and Open Source Data and provide operators with alerts as related to suspect vessels, cargo, personnel or MDA conditions of interest.
Question	Are the User-defined alarms and alerts in MASTER reliable, trusted and accurate?

Measures	Accurate. Reliable & Accurate (assistance to MASTER for building instruments, responsibility for content is JTAA).
Surveys	Reliable, Trusted & Accurate. (assistance to MASTER for building instruments, responsibility for content is JTAA).
Context	
Quest Ans	*Survey Summary*: Respondents agreed that MASTER's user-defined alerts supported accurate detection of conditions of interest. User-defined alerts were considered to be an excellent feature, able to respond to the dynamic maritime threat environment, assuming that users provide accurate rules for alerts. Respondents agreed that it is easy to create or modify user-defined alerts in MASTER, noting that alert templates simplify this task. Several respondents stated that the vessel tracking system they currently use does not support user-defined alerts. *Observer Log Summary*: Users could accurately create and use user-defined alerts. The polygon tripwire tool worked well. Although MASTER was used to successfully accomplish vessel tracking tasks, its reliability was sometimes at issue. For example, problems were encountered with mouse control of map zoom function, necessitating a zoom out all the way to world view and then re-zoom back to area of interest. Operators at COMPACFLT used Firefox preferentially over Internet Explorer, which was unreliable when attempting to run MASTER.
Cntxt Imp	

Thread #	MDA-02.04
Objective	Evaluate the capability to track vessels using National Technical Means and Open Source Data and provide operators with alerts as related to suspect vessels or MDA conditions of interest.
Question	Does MASTER allow for accurate and usable assembly of a User Defined Awareness Picture (UDAP) in the maritime environment, utilizing multiple data sources from multiple security levels and incorporating Geographic Information Systems (GIS) of Infrastructure?
Measures	Accurate (may not be relevant in this sense). Alerts may need to be logged by the system--in addition to observed alerts (captured by observer logs).
Surveys	Accurate & Usable Define responsibilities for developing survey questions--JTAA/NPS/PSE
Context	

Quest Ans	*Survey Summary*: Respondents agreed that they could maintain awareness of the maritime environment through the operational picture in MASTER, but they differed on whether all the data sources needed to perform their tasks were available in MASTER. Sealink was suggested as a data source that could be integrated with MASTER. MASTER's strengths include its ability to support information sharing among users, receive intelligence from sources at the SECRET level and below, create watch areas and briefing materials, and define the operational picture to maintain awareness of the maritime environment. MASTER's user interface was judged to be clear, consistent, and easy to understand, and most respondents found it easy to get MASTER to do what they wanted, given adequate training and practice, which are needed to reach proficiency. Usability drawbacks include multiple click controls (2 or 3 clicks) for various features and slow response times, especially to database queries. MASTER's display also has a tendency to become too cluttered for effective viewing under higher traffic conditions. *Observer Log Summary*: System connectivity was usually adequate during the MASTER scenarios, although the system would go down at times, preventing the execution of the scenarios. Delays in MASTER performance seemed most likely due to MASTER server performance. Multiple simultaneous searches also slowed system response time. Such response time delays could hinder the timely assembly of a UDAP in up-tempo operations. The accuracy of the results generated by MASTER depend on a user's skill in selecting and applying the appropriate filtering criteria. The need to manually correlate some data elements across various MASTER screens introduces the potential for user error. Correlations should be system automated. Numerous usability issues were observed that could prevent the generation of accurate and usable UDAPs, including: the inability to cancel a query; the use of non-standard command input (e.g., 2- or 3-click inputs and the map's zoom controls); the inability to perform multiple simultaneous queries; the inability to sort search results by the result's fields; and the inability to perform follow-on searches based on a prior search. Also, the addition of visual/auditory cues for the alarm/alert windows would prompt users to review them for status changes, which several users failed to do.
Cntxt Imp	

Thread #	MDA-02.05
Objective	Evaluate the capability to track vessels using National Technical Means and Open Source Data and provide operators with alerts as related to suspect vessels, cargo, personnel or MDA conditions of interest.
Question	Does MASTER allow for ingest, accurate vetting and display of people data associated with maritime vessels and maintain an association of certain people with ships both past and present?
Measures	Accurate. What system logs, and how will they be extracted?
Surveys	Accurate
Context	
Quest Ans	*This Thread was dropped - People Awareness feature is not implemented in the current version of MASTER*
Cntxt Imp	

Thread #	MDA-02.06
Objective	Evaluate the capability to track vessels using National Technical Means and Open Source Data and provide operators with alerts as related to suspect vessels, cargo, personnel or MDA conditions of interest.
Question	Does MASTER provide a useful and accurate replication of ONI's Global Trader cargo tracking and alerting capability, allowing a linkage of vessels and related cargo?
Measures	Accurate

Surveys	Accurate & Usable
Context	
Quest Ans	*Survey Summary*: Most respondents (13 of 20) agreed that MASTER allowed them to determine linkages between cargo and vessel. Several respondents noted drawbacks in the content and capabilities of the Cargo database, such as cargo data being limited and hard to find in MASTER, but others said it exceeded their expectations. *Observer Log Summary*: Cargo information provided by MASTER was usable, but could be more complete. Cargo Link was preferentially used instead of MASTER to obtain cargo information by several users, who judged Cargo Link to be more extensive. According to an observer, the MASTER Cargo results screen has redundant information and no interactivity. It requires users to review pages of data, document potential leads into a list of items, and to then run many individual queries. Some users indicated they need the ability to select individual cargo results and draw the tracks on the map in a manner similar to the track query select/draw function The accuracy of MASTER's database appeared to be adequate, although its completeness compared to a specialized cargo database, such as Cargo Link, was questioned.
Cntxt Imp	

Thread #	MDA-04.01
Objective	Assess the usability and operational utility of PANDA to intelligence analysts and watchstanders for representing normal/predicted vessel behavior and detecting/alerting deviations from normal vessel behavior
Question	Is PANDA's representation of predicted/normal vessel behavior and detection of/alerting to deviations from normal relevant/clear to and trusted by intelligence analysts and watchstanders?
Measures	
Surveys	Usable - Clear, Relevant and Trusted: Users can be analysts and operators (different tasks / different perspective, assessment of utility, etc) Survey or interviews for depth. Observers verify that PANDA alerts deviation when it occurs (based on scenario events) Clear: Determine whether users notice and/or use alert
Context	
Quest Ans	
Cntxt Imp	

Thread #	MDA-04.02
Objective	Assess the usability and operational utility of PANDA to intelligence analysts and watchstanders for representing normal/predicted vessel behavior and detecting/alerting deviations from normal vessel behavior.
Question	Does PANDA provide a needed capability for monitoring and providing situation awareness about vessels of interest and is the information provided by PANDA applicable information to support the analysis of VOIs?
Measures	
Surveys	Utility: Needed, Applicable In addition, questions to operators, as well as ONI watchfloor operator to help capture if PANDA information gets into decision chain
Context	
Quest Ans	
Cntxt Imp	

Thread #	MDA-06.01
Objective	Integrate unclassified track and reference data from DoD, coalition, and commercial sources to provide the unclassified COP portion of Global Maritime Situational Awareness.
Question	Can various track data sources be integrated into MIDAS in a timely manner to provide a relevant picture in support of Global Maritime Situational Awareness?
Measures	
Surveys	timely and relevant
Context	Limited Observation data was collected.
Quest Ans	MIDAS does provide the ability to provide a relevant, unclassified picture in support of Global Maritime Situational Awareness in a relatively timely manner. The observer offered some design suggestions that should improve the operator's ability to make modifications in less time -- i.e., allow changes to be made at both line and pie charts; have ability to filter on vessel size; auto-insert the lat/long value into the data box.
Cntxt Imp	Data are mostly operator estimates versus actual experience with MIDAS in an operational setting.

Thread #	MDA-06.02
Objective	Integrate unclassified track and reference data from DoD, coalition, and commercial sources to provide the unclassified COP portion of Global Maritime Situational Awareness.
Question	Does MIDAS provide relevant and timely information to distributed planners?
Measures	
Surveys	timely & relevant
Context	There was only one instance of MIDAS in TW08; therefore, there was no ability to execute distributed planning.
Quest Ans	MIDAS was estimated to have the ability to provide relevant unclassified information with other agencies and non-traditional partners. Estimates of timeliness were divided; determination of timeliness requires actual execution.
Cntxt Imp	Reports represent participant estimates only, as no distributed planning was actually attempted.

Thread #	MDA-06.03
Objective	Integrate unclassified track and reference data from DoD, coalition, and commercial sources to provide the unclassified COP portion of Global Maritime Situational Awareness.
Question	Can MIDAS be trusted to exchange relevant and reliable data and alerts with MDA Data Sharing COI, Google Apps, NCIS, FIAC, and also EMIO, VBSS, TBCMS and MCSBEN (boarding data)?
Measures	reliable & relevant Data logs from MIDAS and SIDI.
Surveys	reliable & relevant
Context	Limited observation data.
Quest Ans	In general, operators believed that MIDAS could assist them to exchange relevant and reliable data with multiple sources. Actual data exchange occurred successfully with MDA DS COI.
Cntxt Imp	The assessment of reliability of data provided via MDA DS COI is based on minimal observances; therefore, actual reliability over multiple times and situations is not known.

Thread #	MDA-10.01

Objective	Develop an effective SOA Data Exchange and Correlation Measure network traffic flow and Secure Data Exchanges and Cross Domain Communications.
Question	Can SIDI provide a flexible, secure and timely SOA web service translation capability between unclassified MDA data sources?
Measures	Timely info exchange, secure decryption
Surveys	Report of encryption - decryption test for secure. Timely information exchanged (by packet size, type, location). Report of ingestion of multiple formats and conversion appropriate to customers for flexible
Context	o There were 3 SIDI servers for scenario 1 – on EMIO laptop atop COMPOSE 3.0 of USS Comstock, shore-based (Pt. Loma) on CANES (ISNS-NGT) blade server, and a reachback server on a Windows Server at St. Louis, MO. o There were 2 SIDI servers for scenario 2 – on VPN server hosted at St. Louis, MO, and the reachback server on a Windows Server at St. Louis, MO.
Quest Ans	SIDI was able to provide a flexible and timely means of translating and transmitting data to many receivers. Due to restrictions, the secure component of the experiment was discarded.
Cntxt Imp	Performance issues on VMWare servers resulted in the encryption – decryption test for secure being removed from the experiment.

Thread #	MDA-11.01
Objective	The MDA DS COI provides a seamless information sharing infrastructure to provide data producers and consumers a single/common methodology for exposing, discovering, publishing and subscribing to unclassified MDA data.
Question	Is the MDA DS COI AIS data available and accessible in a timely manner to the unanticipated user?
Measures	Available: information flow of AIS data. Time required to complete view VOLPE unclassified MDA data (VOPE, Global Hawk, SMS/SCC J, augmented unclassified MDA, historical unclassified MDA, anomalies for unclassified MDA).
Surveys	**Accessible** - Could the operator access the MDA DS COI GMMS Website?, Were the operator's information sharing attempts seamless (i.e. did the site provide a single source to access unclassified MDA data from multiple sources)? **Timely** - Was data available when needed through MDA DS COI GMMS website? **Available** - view of MDA data (Navy unclassified, ARMS unclassified, Global Hawk unclassified, SMS/SCC J unclassified, augmented unclassified, historical unclassified, anomalies for unclassified. **Usable** - Did the operator appear overwhelmed/confused/make observable errors at any point while using MDA DS COI GMMS website?
Context	Observations took place at COMTHIRDFLEET and COMPACFLEET, during discreet usage events between 0800 and 1530 PDT.
Quest Ans	Overall, MDA DS COI (web version) was **accessible** by all operators. However, there were some challenges with regard to **timeliness**; operators stated that the website was slow. The majority of data sources (5 of 8) were **available** through MDA DS COI. Survey respondents reported moderate availability of data.
Cntxt Imp	**From Qualitative data:** The timing of usage events may have resulted in non-representative observations of availability of data sources, due to time zone differences.

Thread #	MDA-11.02
Objective	The MDA DS COI provides a seamless information sharing infrastructure to provide data producers and consumers a single/common methodology for exposing, discovering, publishing and subcribing to unclassified MDA data.
Question	Is the MDA DS COI data available to the anticipated user within a reasonable timeframe?
Measures	Yes -- Timely, Available: AIS information flow

Surveys	Yes -- Timely, Available, Usable
Context	Links to MDA DS COI data were embedded in four different TW08 technologies – CLA, MASTER, MIDAS, and CMA. It was incumbent upon Technical SMEs and/or observers to ensure that operators (a) understood the relationship between the MDA DS COI and the host technology, and (b) attempted to use MDA DS COI. This did not always occur; in the cases of CLA and CMA, no usable data was reported.
Quest Ans	• **Accessible**: Yes. Qualitative feedback from observer logs for MIDAS and MASTER technologies indicated that users were able to access MDA data from various sources through the MDA DS COI. • **Timely**: No. Feedback from observer logs for MASTER indicated that operators had difficulty staying on mission timelines due to challenges with running queries. Specifically, some operators took notes by hand, others reported difficulty passing information from one query to the next, others reported only being able to do 1 query at a time. • **Usable**: Feedback indicates that Usability was relatively low. Users were able to identify suspect VOIs. However, it was difficult. One observer stated "This user interface needs major improvement with respect to correlating data relationships between popup windows and the map, and the track data playback function. The process requires the operator to bounce between track data popup spreadsheets and layer tools lists. The operators had to manually document record track identifier numbers to compare data list on other windows. This process is prone to errors as demonstrated during this event."
Cntxt Imp	Assessments with all planned technologies did not occur. Given the hosted relationship of MDA DS COI for this event, GUI design was rudimentary, as reflected in feedback regarding Usability.

Thread #	MDA-12.01
Objective	Determine if FP Portal is a viable collaboration platform to exchange Maritime information with mission partners.
Question	Is the FP Portal accessible, reliable and usable for the sharing of relevant information between distributed NCIS agents?
Measures	accessible (log on success and failure), reliable (up and down times): consider bandwidth usage measurements (FP servers. BW measures at BHR. Different nodes may have different means (expeditionary comms, PDA, PC etc) to log into the Portal.
Surveys	operator experience (accessibility, reliability, usability). HI, Bahrain, Dubai, Singapore, NCIS NORTHWEST, C3F, NCIS HQ at Navy Yard DC. Possibly on BHR. PACFLT for Spiral-1? Relevant
Context	NCIS Agents and Field Officers at several remote locations logged into FP Portal and participated in collaboration experiment to 'solve' a case.
Quest Ans	Accessibility of the FP Portal was high, even from mobile device. Information entered into the Portal was reliably saved and available. Connectivity was good, although some problems were reported via access with NMCI. Most users reported that features of the Portal were easy to understand and customize, although one user requested a simpler interface. It was suggested that the Chat feature of the Portal may not be the best method to Communicate urgent messages as it was often unclear whether desired contacts were logged in; this would require log-in and usage procedures to be adopted.
Cntxt Imp	Mimicked real-world usage of the portal.

Thread #	MDA-13.01
Objective	Demonstrate the abiilty to share Law Enforcement information derived from LInX and make associations with other disparate information provided via MDA.
Question	Does LInX provide an accessible, reliable and usable information environment for assisting in making connections between other information types, such as from other MDA sources?
Measures	accessible, reliable: system log (from LInX)

Surveys	operator perspective of accessibility, reliability, and usability -- also utility of the available info to the MDA community (all access to LInX via FP Portal for TW). Observations to be used to report means of access (Expeditionary comms device, TREO, Blackberry, workstation etc) and performance (access, reliability and usability).
Context	One respondent reported not using LInX but requesting it via the MEFO.
Quest Ans	LInX was accessible via the FP Portal. Participants reported excellent ability to move between FP Portal and LInX. The information available through LInX was rated as Moderate to High value, although one respondent wanted more depth of social linkage information. Respondents generally trusted the sources that provided information to LInX.
Cntxt Imp	One respondent's replies do not reflect use of LInX. This respondent's experience to gain access to LInX is likely a function of the experiment control.

Thread #	MDA-14.01
Objective	Expand the NCIS source infrastructure to include contacts in pillar MDA domain areas: cargo, people, critical infrastructure, vessels.
Question	Can field agents establish sources across the MDA pillars of vessels, cargo, people, and critical infrastructure?
Measures	field agent self-report of numbers and descriptions of sources that were established (include associated MDA pillar area of each source)
Surveys	able to re-establish with contacts on demand? (reliable) how much human resources involved in creating and maintaining? (workload=efficient)
Context	Only one location provided Observation data. Reports suggest that this Objective-Question was not fully tested.
Quest Ans	The amount of information exchanged did not increase appreciably during the experiment over real-world conditions; the report of contacts established was not high. It was estimated that workload to establish and maintain contacts would be the same or higher, but that re-connecting with those contacts, once established, would be easy. There was strong agreement that the MDA Social Network is potentially a very valuable source of contacts.
Cntxt Imp	Responses are largely estimations vs. actual experience. This may have been a function of the scenario or the fact that participants had real-world responsibilities in addition to participating in the experiment.

Thread #	MDA-14.02
Objective	Improved C2 processes among Navy, International, Industry, Non-Governmental, and Interagency organizations through NCIS, to enable a Law Enforcement Network to support global Maritime Domain Awareness activities so that Operational and Tactical level decision makers recognize the value of law enforcement activities in support of critical MDA processes.
Question	Are TW08 MDA net-centric services accessible, reliable, capable and usable as integrated features for nodes within the MDA Community of Interest?
Measures	
Surveys	Need to define the integration of services that should be available at nodes. Accessible, Reliable, Capable, Usable
Context	Only 1 location provided Observation data, the only net-centric services reported were FP Portal and LInX. Participants may not have understood or had time to explore other potential services.
Quest Ans	The net-centric services reported (i.e., FP Portal and LInX) were accessible, reliable, and capable. Responses at Objectives 12 and 13 suggest a high level of usability, although integration of services was not specifically reported.
Cntxt Imp	This Objective-Question may not have been fully tested, as FP Portal and LInX were only services reported.

Thread #	MDA-15.01
Objective	Distribute MDA-related information derived from LInX, FP Portal and the NCIS social network to watch standers.
Question	Does access to information derived from LInX, FP Portal and the NCIS social network provide watch teams working within core MDA processes sufficient and timely information?
Measures	
Surveys	sufficient, timely - MOC watchstanders & watch officer -- receipt of, value of information. Observation of flow of information
Context	No actual interaction with watch teams was reported.
Quest Ans	Information was derived in a timely manner from LInX, FP Portal, and the NCIS Social Network. Estimations are that this information would be sufficient to support core MDA processes for watch teams.
Cntxt Imp	Reports regarding sufficiency for watch teams(from Observation only; no Survey responses were received) are estimates only.

Thread #	MDA-15.02
Objective	Distribute MDA-related information derived from LInX, FP Portal and the NCIS social network to watch standers.
Question	Do data sharing agreements and policy changes initiated for TW 08 suffice to allow adequate information sharing between the Law Enforcement COI and the global/regional MDA COI?
Measures	
Surveys	
Context	
Quest Ans	
Cntxt Imp	

Thread #	MDA-16.01
Objective	Inform the Draft CONOPS for NCIS Support to MDA through data collected in TW 08.
Question	Does the NCIS MDA Draft CONOPS accurately represent the actual workflow and information exchange relative to TW 08 MDA activities?
Measures	
Surveys	
Context	
Quest Ans	
Cntxt Imp	

Thread #	MDA-17.03
Objective	Provide effective analysis tools to understand the Cargo Pillar in support of Maritime Domain Awareness processes amongst distributed partners.
Question	Does Cargo Link provide a usable and sufficient Cargo data query tool for analysts/operators in other MDA nodes that are not Cargo experts?

Measures	
Surveys	
Context	Connectivity was adequate during ~85% of the usage situations. However, there were 8 reports of long processing times (2 – 5 min.) or timing out during queries. Usage scenario was very directed – very little free play.
Quest Ans	Based on survey and observer log results, CargoLink was a usable and sufficient data query tool for analysts who are not cargo experts. Survey respondents indicated that they understood the features of CargoLink, could easily manage data in CargoLink, and CargoLink was adequate to perform analysis of cargo that is associated with a vessel. However, roughly 1/3 of respondents did not endorse (i.e., they disagreed or were neutral) the relevance of CargoLink to the analysis that they do for their jobs, and roughly 1/3 of operators were reported to be frustrated at some point during their session.
Cntxt Imp	It was not possible to determine if connectivity problems contributed to long search times and time-outs. With limited free play, ability of the operators (who were not cargo experts) to assess relevance to their jobs may have been restricted.

14.0 Appendix H: Assessment Framework

Portions of the following material are presented in Section 2. The full structure is presented here for completeness.

14.1 Assessment Areas and Objectives

The assessment structure is organized around five Assessment Areas, shown in Table I1. The basic MDA **assessment objectives** are to determine

- Effectiveness and
- Military Utility.

Definitions of both are given in Section I.4. Effectiveness is determined for all four Assessment Areas. Military Utility is determined only for systems.

MDA assessment objectives are to determine the following.

System Performance evaluates:

- How well the system performs its functions
- How well the system supports MDA operations
- Warfighter acceptance of the system
- Whether or not the system provides automated support
- Quality of system management and security

Operations Performance evaluates:

- Quality of knowledge processes, particularly in support of MDA
- Quality of ISR operations in support of MDA
- Quality of MIO operations

Warfighter Performance focuses on:

- Operator acceptance and understanding of the MDA mission
- Capabilities of units to carry out MDA operations and activities
- Human capabilities to carry out MDA tasks

Organization/Guidance focuses on:

- MDA organization compatibility other organizations and their processes
- MDA organization compatibility with MHQ/MOC
- Sufficiency of agreements to enable MDA operations
- Guidance sufficiency to support operations

Supportability and Readiness refers specifically to MDA Spiral-1 systems and is reported by PEOC4I. A brief summary of their results is provided here for completeness of this report.

Table I1 provides more granularity to the assessment structure, showing the three-level evaluation structure.

Table 19. MDA Assessment Areas and Structures.

System Performance	
Technical Performance	
Information Retrieval	
Information Processing	
Information Sharing	
Operator Configurable	
Interoperability	
Operations Support	
System Utility	
Standards and Guidelines	
Warfighter Acceptance	
System Utility	
Human-System Interaction	
System Usage	
System Training	
Automation	
Alerts	
Information Processing	
Smart Pull	
System Management and Security	
Warfighter Performance	
MDA Mission	
Mission Understanding	
Mission Acceptance	
Unit Performance	
Manning	
Activities	
Training	
Human Performance	
Tasks	
Training	
Operations Performance	
Knowledge Processes	
Information Retrieval	
VoI Development	
VoI Tracking	
Information Sharing	
ISR	
Planning	
Execution	
PED	
MIO	
Planning	
Execution	
Assessment	
Organization/Guidance	
MDA Compatibility	
Organization Alignment	
Process Alignment	
MHQ/MOC Compatibility	
Organization Alignment	
Process Alignment	
Agreements	
Information Sharing	
Shared Operations	
Guidance	
CONOPS	
TTP/SOP	
Standing Orders	
System Supportability and Readiness	
PEO Provided	

14.2 Assessment Metrics

The overarching purpose of the assessment is to determine Capability Indicators. As noted above, the basic indicators are Effectiveness and Military Utility. These indicators are evaluated through their included measures, MOU, MOE, and MOP. The measures used for the MDA

Assessment Areas are shown in Table 21, using their attributes. Attributes rather than measures are shown in the table for semantic ease.

Table 20. MDA Capability Indicators (MOE and MOU)

Area	Effective	Utility	Area	Effective
Systems	Accessible Capable Reliable Usable	Improved Needed Applicable Wanted	Warfighter	Capable Reliable
Operations	Accessible Capable Reliable		Organization /Guidance	Accessible Capable Usable

These attributes are chosen from complete structure which was developed for NAVNETWARCOM for use in its Capabilities Based Analyses, a component of the JCIDS process. This structure was developed to conform with three of the JCIDS JFAs: NCO, BA, and C2. Table I3 lists the effectiveness and utility attributes (which defined the four MOE and four MOU). Under each of the MOE attributes are their associated MOP attributes.

Table 21. Complete Attribute Structure.

Effective				
Accessible	**Reliable**	**Capable**	**Usable**	**MOE**
Capacity	Robust	Sufficient	Clear	**MOP**
Available	Persistent	Flexible	Trusted	"
Compatible	Secure	Accurate	Manageable	"
Extensive	Assured	Timely	Relevant	"
Efficient		Reach	Compliant	"
		Automatic	Deployable	"
Military Utility				
Improved	**Needed**	**Applicable**	**Wanted**	**MOU**
Ready				
Effective	**Utility**	**Life-Cycle**	**Personnel**	**MOR**
System Readiness is a roll up of the component readiness measures (MOR).				

Table I3 shows that MOP are assigned to specific MOE. This shows principal assignments, the MOPs that would normally be rolled up to provide an MOE determination. It is possible, and not unusual, to use an MOP for a different MOE than is shown in the table, e.g., the MOP

compatible could be used with the MOE capable to determine if organizations' processes were compatible so personnel could collaborate over decision-making.

14.3 Assessment Measures

Table I4 presents the measures that are to be evaluated for each Assessment Area. Attributes are in bold, followed by their associated measures.

Table 22. MDA Assessment Metrics.

MDA Assessment Metrics		
	MOE	
	MOP or MOU	
Spiral-1 System Performance (each system)		
Technical Performance		
	***Improved**: -5 to +5 rating of improvement over existing systems, by system aspect.* ***Needed**: system fills a gap in existing capabilities, Y/N.* ***Applicable**: system is applicable to MDA activities, by activity, Y/N.* ***Wanted**: -5 to +5 rating of operator desire to have system available.*	
Information Retrieval	**Accessible**: roll-up of information accessibility.	
	Available: % of time information is available. **Efficient**: number of steps to access information.	
	Capable: roll-up of capability to retrieve required information.	
	Sufficient: % of information needed for assessment. **Timely**: time required to retrieve information.	
	Reliable: roll-up of ability to obtain correct information when needed.	
	Assured: information source is identified, Y/N. **Robust**: automatic failover during system problems, Y/N; database backup, Y/N. **Persistent**: % of time down due to system failure.	
	Usable: roll-up of information usability for assessment and decision-making.	
	Clear: 1-5 rating of information clarity; 1-5 rating of GUI presentation. **Trusted**: 1-5 rating of confidence in information.	
Information Processing	**Capable:** roll-up of ability to process ship and VoI information.	
	Available: information processing capabilities, Y/N; list capabilities. **Efficient**: use of information processing capabilities, by capability, Y/N. **Sufficient**: information processing capabilities for operations needs, Y/N. **Automatic**: automatic information processing available? Y/N	
Information Sharing	**Accessible**: roll-up of information sharing accessibility.	
	Compatible: M2M interoperability, by system, Y/N. **Available**: % of time information sharing available. **Efficient**: information sharing efficient, Y/N; number of steps required to share information.	
	Capable: collaboration capabilities provided, Y/N; roll-up of capability to share information with other units.	

	Reach: number of units with which information can be shared; number of units per collaboration session. **Sufficient**: % of required units with which information can be shared; % of required information that can be shared. **Timely**: time required to exchange information.
Operator Configurable	**Capable**: 1-5 rating of the ability of operator to configure the system as desired. **Flexible**: Operator can configure information search, information presentation, Y/N. **Sufficient**: fraction of required profile types that can be developed. **Reach**: Number of profiles that can be saved. **Efficient**: 1-5 rating of system configuration efficiency; number of steps required to configure system, by configuration type.
Interoperability	**Compatible**: M2M system interoperability, by system, Y/N; information formats compatibility, by system, Y/N.
Operations Support	
System Utility	***Improved**: -5 to +5 rating of improvement of MDA operation activities over existing systems, by activity.* ***Needed**: system fills a gap in existing support to MDA operations, Y/N.* ***Applicable**: system is applicable to MDA activities, by activity, Y/N.* ***Wanted**: -5 to +5 rating of operations center desire to have system available.*
Standards and Guidelines	**Usable**: roll-up assessment of Standards and Guidelines for system usage. **Sufficient**: % of system operations covered by guidelines; standards to cover information formats, Y/N; standards to cover M2M interactions, Y/N. **Clear**: guidelines to direct system operation, Y/N. Prepare a list of those situations for which Standards/Guidelines are inadequate.
Warfighter Acceptance	
System Utility	***Improved**: -5 to +5 rating of improvement of operator's task performance over existing systems, by task.* ***Needed**: system fills a gap in existing support to task performance, Y/N.* ***Applicable**: system is applicable to MDA tasks, by task, Y/N.* ***Wanted**: -5 to +5 rating of operator desire to have system available.*
Human-System Interaction	**Usable:** 1-5 scale roll-up of human-system-interaction. **Clear**: 1-5 scale on GUI presentation. **Manageable**: GUI can be configured to operator desired presentation, Y/N. **Relevant**: information presented is relevant to operator task performance, Y/N. **Timely**: GUI layout and information presentation facilitates rapid retrieval of needed information, Y/N; time to retrieve needed information. **Efficient**: number of steps required to retrieve needed information; 1-5 scale on GUI facilitation of information retrieval efficiency.
System Usage	Prepare a table of frequency of Spiral-1 system use, by situation and by task.
System Training	**Usable**: 1-5 scale roll-up of training quality. **Clear**: 1-5 scale on training clarity. **Sufficient**: 1-5 scale on sufficiency of training to prepare operator for tasks. **Relevant**: 1-5 scale on whether training is relevant to mission and workflow.
Automation	
Alerts	**Capable:** alerts are provided, Y/N; roll-up of quality of alerts.

	Automatic: **Flexible**: alerts operator configurable, Y/N; number of different types of alerts available. **Trusted**: 1-5 rating of alerts eliminating need to monitor situation. **Sufficient**: % of needed alerts provided by system, % of needed alert types provided by system. **Timely**: alerts provided in time to take needed actions, Y/N.
	Efficient: 1-5 rating of efficiency setting up alerts; number of steps required to set up alerts.
Information Processing	**Capable:** machine assisted information processing provided, Y/N; system automated information processing available, Y/N; roll-up assessment of information processing capability. **Automatic**: hands-off information processing available, Y/N. **Flexible**: system information processing operator configurable, Y/N. **Trusted**: 1-5 rating of ability to accept hands-off information processing. **Sufficient**: % of information processing requirements performed by system.
Smart Pull	**Capable:** smart pull capable, Y/N. **Automatic**: smart pull automatic updates, Y/N. **Flexible**: smart pull operator configurable, Y/N; number of different types of smart pull available. **Trusted**: 1-5 rating of smart pull reliability to provide required information. **Sufficient**: % of required information available by smart pull.
System Management and Security	
	Accessible: roll up of system management functions for overall accessibility. List any significant causes for lack in accessibility. **Reliable**: % of time system is down. **Secure**: % of attacks that disrupt system performance. **Manageable**: time required to repair/reconfigure system after failure. **Sufficient**: information in status reports to manage system, Y/N. **Accurate**: % of system status reports that are correct.
Operations Performance	
Knowledge Processes	
Information Retrieval	**Accurate**: % of retrieved information that conforms to ground truth. **Flexible**: number of sources that can be accessed to provide information, by information type. **Sufficient**: information available to assess vessels in AoR; information available to conduct MDA operations; **Timely**: time to retrieve information, by information type; information in time to take needed actions. **Efficient**: 1-5 rating of information retrieval efficiency, by information type; Number of steps required to retrieve information, by information type.
VoI Development	**Accurate**: % of correct assessments of vessel classification, threat. **Timely**: time to complete VoI assessment and classification.
VoI Tracking	**Capable**: 1-5 rating of ability to track vessels; roll-up summary of vessel tracking capabilities.

		Accurate: mean vessel location error, by vessel type. **Flexible**: number of different types of vessels that can be tracked by (radiating, AIS, etc) **Reach**: geographical area over which tracking can be accomplished. Sufficient: % of AOR over which tracking can be accomplished. **Timely**: time to locate vessel; frequency of vessel reports.
	Information Sharing	**Capable**: collaboration capabilities provided, Y/N; roll-up of capability to share information with other units.
		Reach: number of units with which information can be shared; number of units per collaboration session. **Sufficient**: % of required units with which information can be shared; % of required information that can be shared. **Timely**: time required to exchange information, ops centers and reachback.
		Compatible: system interoperability, Y/N; information formats, by unit, Y/N.
		Accessible: roll-up of information sharing accessibility.
		Compatible: M2M interoperability, by system, Y/N. **Available**: % of time information sharing available. **Efficient**: information sharing efficient, Y/N; number of steps required to share information.
	ISR	
	Planning	**Sufficient**: % of RFIs addressed; % of available assets assigned. **Timely**: time to plan; planning completed in time for execution.
	Execution	**Accurate**: % of assets conforming to planed actions. **Sufficient**: % of assets completing assignment.
	PED	**Accurate**: % of assessments conforming to ground truth. **Timely**: time to complete processing, exploitation, distribution; distribution in time to meet planning cycle.
	MIO	
	Planning	**Sufficient**: % of RFIs addressed; % of available assets assigned. **Timely**: time to plan; planning completed in time for execution.
	Execution	**Accurate**: % of assets conforming to planed actions. **Sufficient**: % of assets completing assignment.
	Assessment	**Accurate**: % of assessments conforming to ground truth. **Timely**: time to complete reachback, personnel assessment, ship threat assessment.
Warfighter Performance		
	MDA Mission	
	Mission Understanding	**Clear**: 1-5 rating of understanding of activities and tasks, by position.
	Mission Acceptance	**Clear**: **Compliant**: 1-5 rating of individual, unit readiness to undertake MDA mission, by position. **Compatible**: 1-5 rating on fit and ability to perform MDA tasks with other duties; percent of current tasks that match MDA needs.
	Unit Performance	
	Manning	**Sufficient**: manning to carry out assigned activities, Y/N, % of required. **Compatible**: personnel assigned with activity requirements, Y/N, % match.
	Activities	**Capable**: 1-5 rating of unit ability to undertake assigned MDA activities.

		Timely: time to complete activities. **Compliant**: activity performance complies with CONOPS, rules, agreements, Y/N. **Flexible**: 1-5 rating of unit's ability to respond to different situations.
	Training	**Sufficient**: 1-5 rating of training preparation to perform required activities, by activity and unit. **Relevant**: 1-5 rating of training relevance to assigned activities, by activity and unit.
Human Performance		
	Tasks	**Capable**: 1-5 rating of human ability to perform MDA tasks, by position.
		Timely: time to complete tasks. **Flexible**: respond to situation.
	Training	**Sufficient**: 1-5 rating of training preparation to perform required activities, by task and position. **Relevant**: 1-5 rating of training relevance to assigned activities, by task and position.
Organization/Guidance		
MDA Compatibility		
	Organization	**Capable**: roll-up of fit of the organization's structure to MDA requirements.
	Alignment	**Sufficient**: rolls and decision making agreements to cover MDA contingencies, Y/N. **Compatible**: organization alignment with MDA operations requirements, Y/N. **Flexible**: MDA responsible units can realign in response to situation, Y/N. **Timely**: organizations are self-synchronizing in response to situation, Y/N; time required to synchronize operations.
		Usable: roll-up of how workable organization alignment is to accomplish the MDA mission.
		Clear: responsibilities and command relations between MDA units, Y/N. **Trusted**: partner units to carry out their responsibilities without question, Y/N. **Manageable**: information and decision flow between units, Y/N.
	Process	**Capable**: roll-up of how capable MDA units are of sharing activities/tasks.
	Alignment	**Sufficient**: information sharing agreements to cover MDA contingencies, Y/N. **Compatible**: process is in alignment with MDA operations requirements, Y/N; information sharing between MDA units, Y/N. **Flexible**: MDA processes can realign in response to situation, Y/N. **Timely**: processes are self-synchronizing in response to situation, Y/N; time required to synchronize processes. **Automatic**: information sharing between MDA units, Y/N.
		Usable: roll-up of how workable activity/task sharing is between MDA units.
		Clear: information sharing processes, Y/N; activity/task execution processes, Y/N. **Trusted**: partner units to carry out their responsibilities without question, Y/N; information provided by partner units, Y/N. **Manageable**: information and workflow between units, Y/N.
MHQ/MOC Compatibility		
	Organization	**Capable**: roll-up of fit of MDA unit's structure to MHQ/MOC.

	Alignment	**Sufficient**: agreements to cover MDA contingencies, Y/N. **Compatible**: organization alignment with MDA operations requirements, Y/N. **Flexible**: MHQ/MOC and MDA units can realign in response to situation, Y/N. **Timely**: organizations are self-synchronizing in response to situation, Y/N; time required to synchronize operations.
		Usable: roll-up of how workable alignment of MHQ/MOC with MDA units is to accomplish the MDA mission. **Clear**: responsibilities and command relations between MDA units, Y/N. **Trusted**: partner units to carry out their responsibilities without question, Y/N. **Manageable**: information and decision flow between units, Y/N.
	Process	**Capable**: roll-up of how capable MDA units are of sharing activities/tasks.
	Alignment	**Sufficient**: information sharing agreements to cover MDA contingencies, Y/N; % of MDA activities that map to MHQ/MOC activities. **Compatible**: processis alignment of MHQ/MOC and MDA operations requirements, Y/N; information sharing between MHQ/MOC and MDA units, Y/N; % of activities that can seamlessly share information, workflow, and responsibilities. **Flexible**: MHQ/MOC and MDA processes can realign in response to situation, Y/N. **Timely**: MHQ/MOC and MDA processes are self-synchronizing in response to situation, Y/N; time required to synchronize processes. **Automatic**: information sharing between MHQ/MOC and MDA units, Y/N.
		Usable: roll-up of how workable activity/task sharing is between MHQ/MOC and MDA units. **Clear**: information sharing processes, Y/N; activity/task execution processes, Y/N. **Trusted**: MHQ/MOC to carry out their responsibilities without question, Y/N; information provided by MHQ/MOC, Y/N. **Manageable**: information and workflow between MHQ/MOC and MDA units, Y/N.
Agreements		
	Information Sharing	**Reach**: Number of different types of information that can be shared. **Sufficient**: % of required information that can be shared. **Compliant**: with information security regulations, Y/N; list barriers to information sharing that impede MDA operations.
	Shared Operations	**Clear**: responsibilities, chain of command. **Sufficient**: % of required units/organizations participating. **Reach**: number of MDA activities that can have shared participation, by activity, list activities, and list participating units.
Guidance		
	CONOPS	**Usable**: roll-up assessment of CONOPS quality to guide MDA operations. **Sufficient**: guidance to conduct MDA, by operation, Y/N. **Relevant**: guidance applies to MDA, by situation, Y/N. **Applicable**: guidance can be applied, by situation, Y/N. **Clear**: guidance to direct activities, by activity, Y/N. **Compliant**: with higher-order directives/doctrine, Y/N.
		Prepare a list of those situations for which CONOPS is inadequate.
	TTP/SOP	**Usable**: roll-up assessment of TTP/SOP quality to direct MDA activities.

		Sufficient: guidance to conduct MDA, by activity, Y/N. **Relevant**: guidance applies to MDA, by activity, Y/N. **Applicable**: guidance can be applied, by situation, Y/N. **Clear**: guidance to direct activities, by activity, Y/N. **Compliant**: with higher-order directives, Y/N.
		Prepare a list of those situations for which TTP/SOP are inadequate.
Standing Orders	**Usable**: roll-up assessment of Standing Orders (ROE, NSL, commander's guidance, etc.) quality to frame MDA operations.	
		Sufficient: guidance to conduct MDA, by operation, Y/N. **Relevant**: guidance applies to MDA, by situation, Y/N. **Applicable**: guidance can be applied, by situation, Y/N. **Clear**: guidance to direct MDA operations, by activity, Y/N. **Compliant**: with higher-order directives, Y/N.

14.4 Attribute Definitions

Effective – Effective is an overarching attribute. It refers to how well systems, people, and processes meet their stated purposes. This attribute has meaning only in reference to that purpose. E.g., it is not sufficient to state that a system is effective without also stating at what.

Accessible – Users have access to needed capabilities and information. This includes access to communication means, data and processed information, systems, software, support, etc. Access will often be through a network. This attribute is one of the four MOE's its component MOP follows.

Capacity – Number of users that can have access; number of services that can be provided; capacity of other systems required for its function, primarily bandwidth. Included is information or service throughput.

Available – System or capability is ready for use, can be used, when needed. It is possible that a capability can be accessed but cannot use at that time.

Compatible – The system or capability can function with other elements external to it without modification to either. It can be integrated with other systems or capabilities. This can also refer to processes or organizations being compatible or integrated.

Extensive – The system or capability is capable of servicing a large number of users, covers a large geographical area, services a large number of user types, and provides a number of different types of service.

Efficient – The number of steps or effort needed to access and use the service is acceptable. This attribute is inherently comparative. Acceptable normally refers to a standard, or an improvement over what was formerly required. Efficiency can be a ratio, a judgment of (result obtained)/(effort required).

Reliable –The capability or information is there when needed, can be depended on. Human and organization reliability is included. This attribute is one of the four MOE; its component MOP follows.

Robust – The system or process is able to withstand stress or attack. Changes in environment are managed with minimal loss of functionality or effectiveness.

Persistent – The system maintains its status over long periods of time (primarily ISR capabilities). Information maintains its content and meaning across processing and distribution means (e.g., tracks).

Secure – The system, process, information, has provisions that prevent unauthorized use, intrusion, or tampering.

Assured – Information is warranted to be correct, the source identified, and non-repudiation in effect. The process is warranted to produce the desired result.

Capable – The system, capability, person, or organization provides the needed services. This attribute is one of the four MOE; its component MOP follows.

Sufficient – What has been provided/received is adequate for the recipient to perform their function. For humans and organizations, the skills available are adequate for task performance. Sufficiency can refer to either quantity or level.

Flexible – The system, process, human, or organization responds easily to the situation or to changing requirements. It is adaptable, can handle/utilize a wide range of types. It is tailorable/customizable to user needs and/or users can make modifications to suite their needs.

Accurate – Information provided is correct, matches reality within acceptable limits. Determinations of accuracy normally require definition of acceptable error limits.

Timely – The occurrence or delivery is within acceptable time limits. This can refer to an elapsed time or to meeting a schedule.

Usable – The system, capability, information, or process can be used. This attribute is one of the four MOE; its component MOP follows.

Clear – How the system or process is to be used is easily understood. Meaning of the information is easily comprehended. Instructions, guidelines, definitions are complete and meaningful.

Trusted – Users believe that the information, process, system, organization, will perform their function in a manner that supports current needs.

Manageable – The system or process can be easily modified or manipulated as needs dictate, often in response to changes in the environment. Included is insuring that the required level of performance is maintained. This includes installation of capabilities.

Relevant – Information provided applies to the current situation. System capabilities are what is needed for current tasks. Processes provide the actions required for current operations.

Compliant – The system or information complies with standards or defined structure and formats. Activities are in conformance with existing CONOPS and TTP.

Military Utility – Military utility the second overarching attribute, and actually is a faux attribute, not actually a description of characteristics but a determination to be made in Military Utility Assessments (MUA). It is used to express that something does/does not contribute to the successful performance of military operations. It is one of the most important considerations for military operations. The four measures of utility (MOU) follow.

Improved – The system, organization, or process improves the conduct of military operations for which they were designed.

Needed – The system, organization, or process fills a gap an identified gap.

Applicable – The system, organization, or process is pertinent to conduct of the operation. Its capabilities match the needs and conduct of the operation.

Wanted – Operational personnel want the capability and utilize it. They do not currently have the capability or would rather use it in place of other available capabilities.

Ready Ready is an official procurement term that refers to the system being ready for fielding. As indicated, it is a roll-up of the other fundamental measures and the life-cycle plan (which includes a personnel plan).

15.0 Appendix I: MDA Workflow Diagrams

Figure 8. MDA Workflow for Afloat Units

Figure 9. MDA Workflow for Biometrics Fusion Center

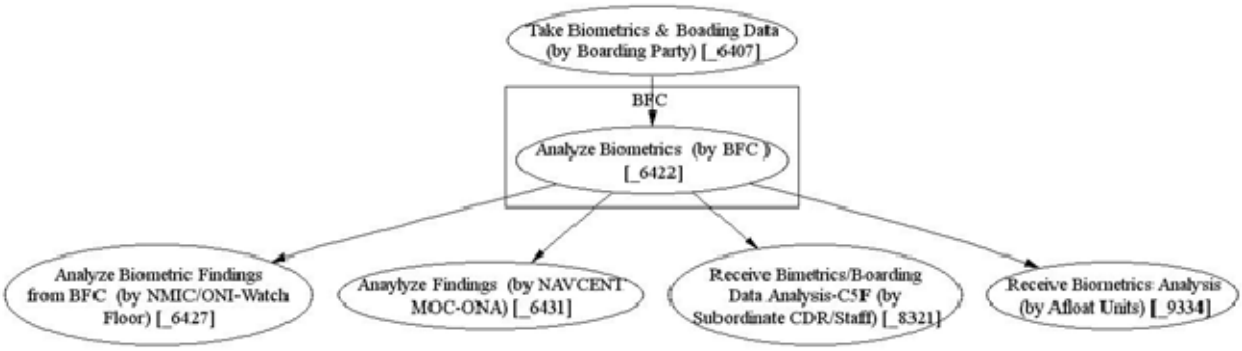


Figure 10. MDA Workflow for Boarding Party

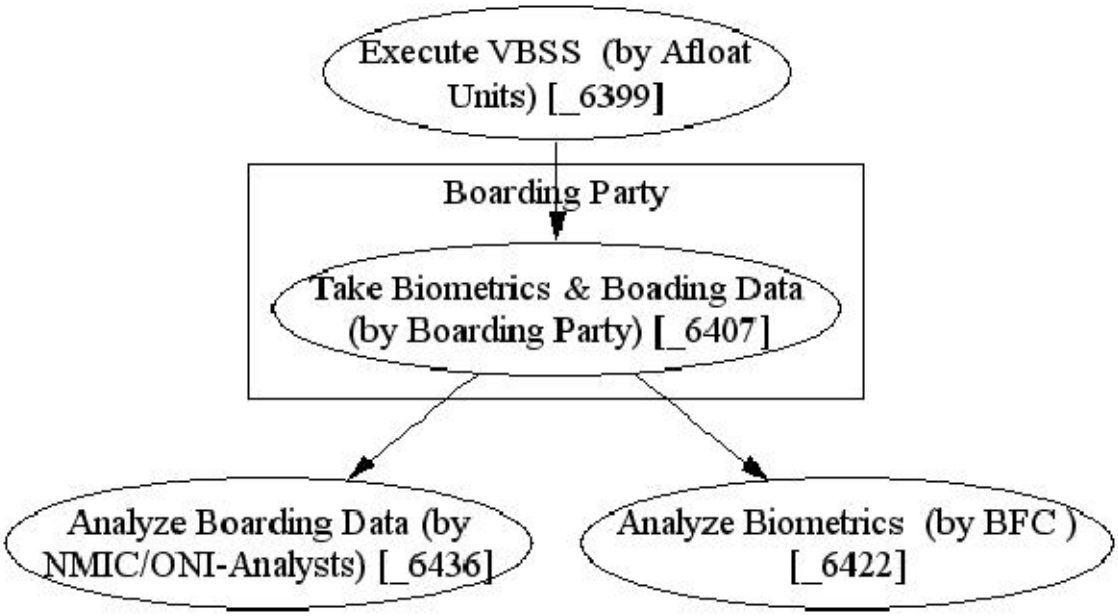


Figure 11. MDA Workflow for CIFC-CIFC/Coalition Forces

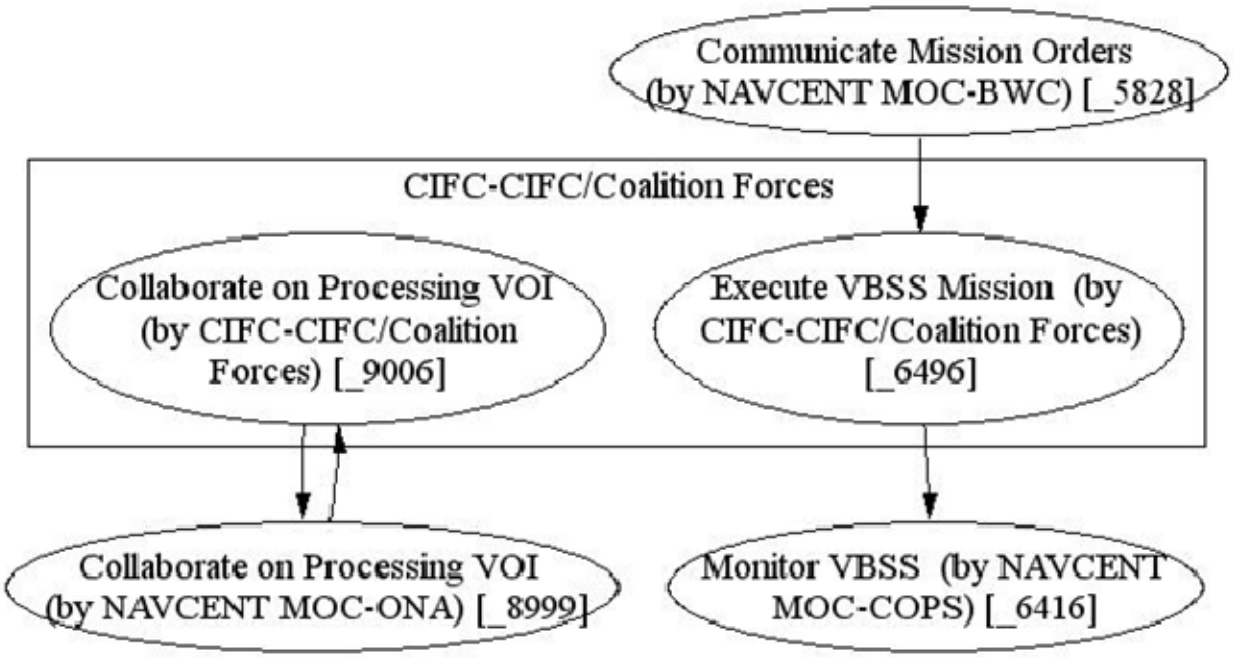


Figure 12. MDA Workflow for CIFC-Coalition Forces

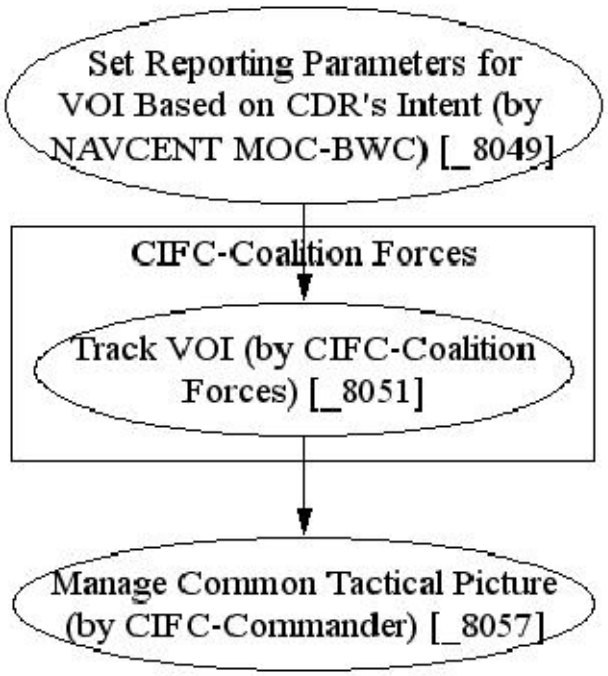


Figure 13. MDA Workflow for CIFC Commander

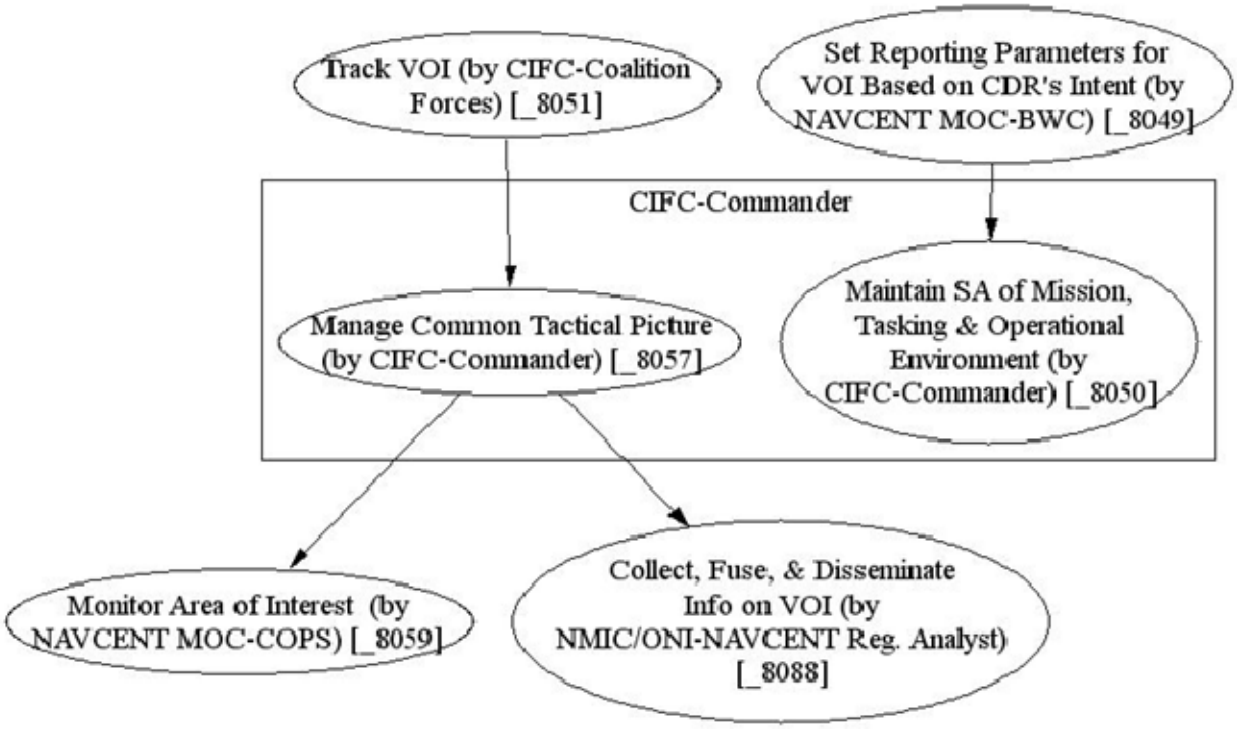


Figure 14. MDA Workflow for CINCPACFLT: BWC

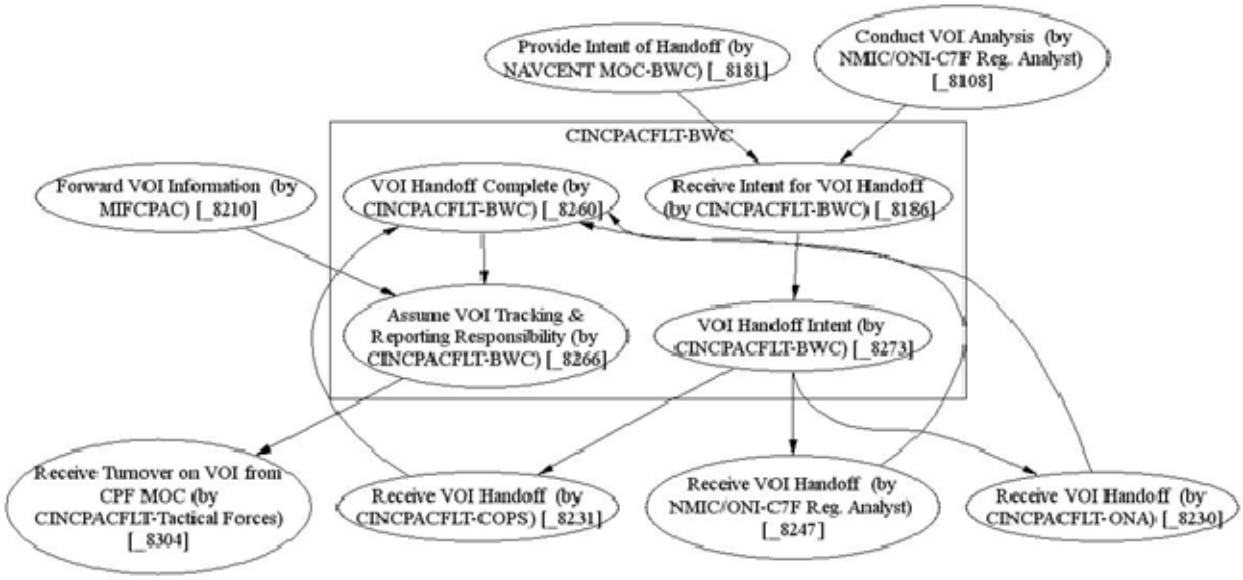


Figure 15. MDA Workflow for CINCPACFLT: COPS

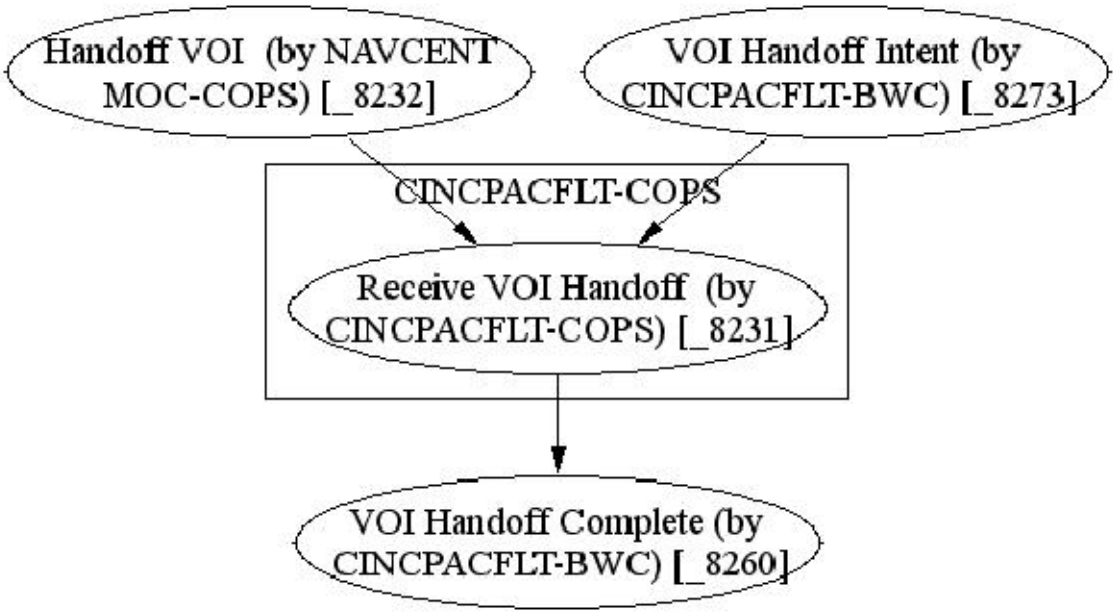


Figure 16. MDA Workflow for CINCPACFLT: ONA

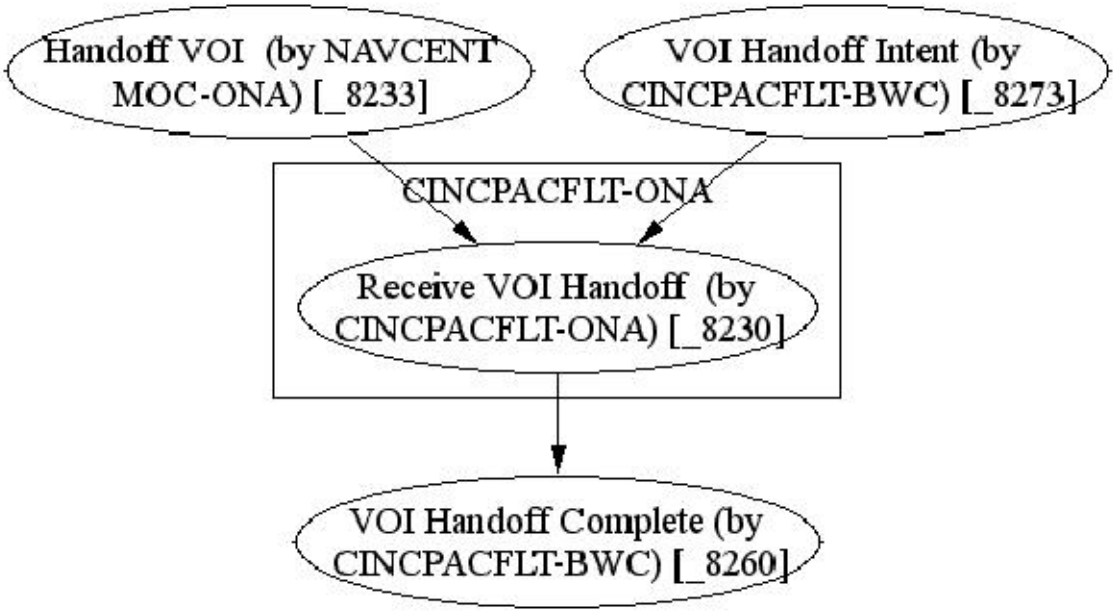


Figure 17. MDA Workflow for CINCPACFLT: Tactical Forces

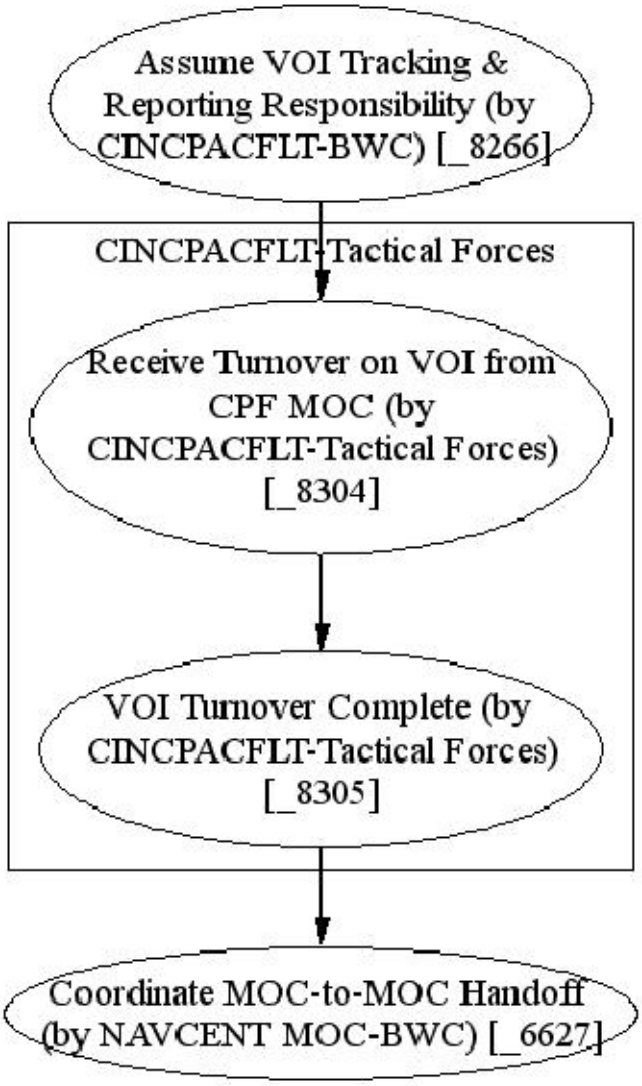


Figure 18. MDA Workflow for CINCPACFLT

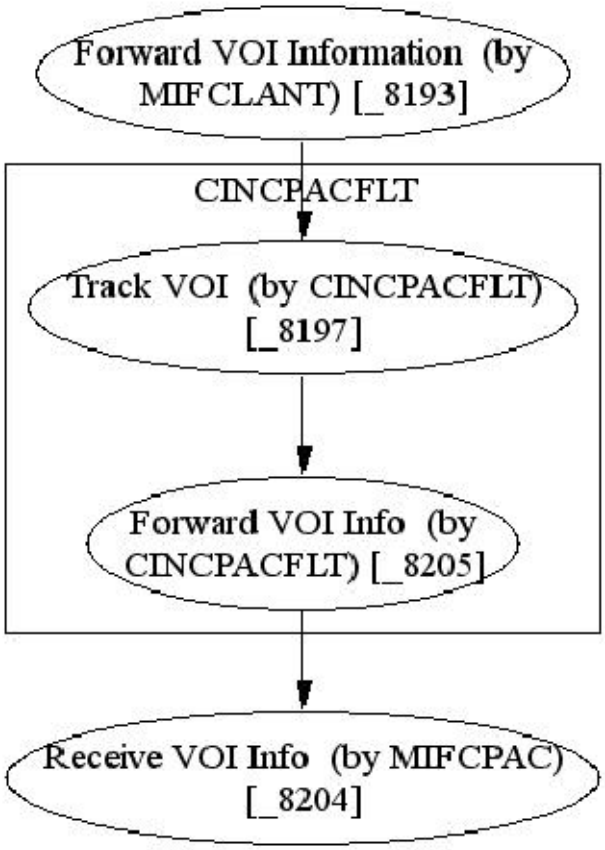


Figure 19. MDA Workflow for COCOM

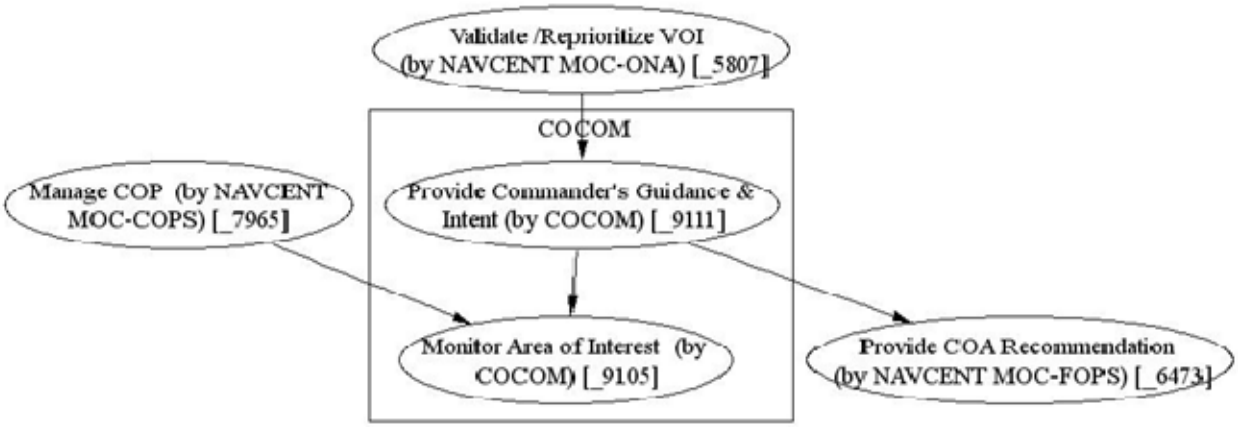


Figure 20. MDA Workflow for MARLO

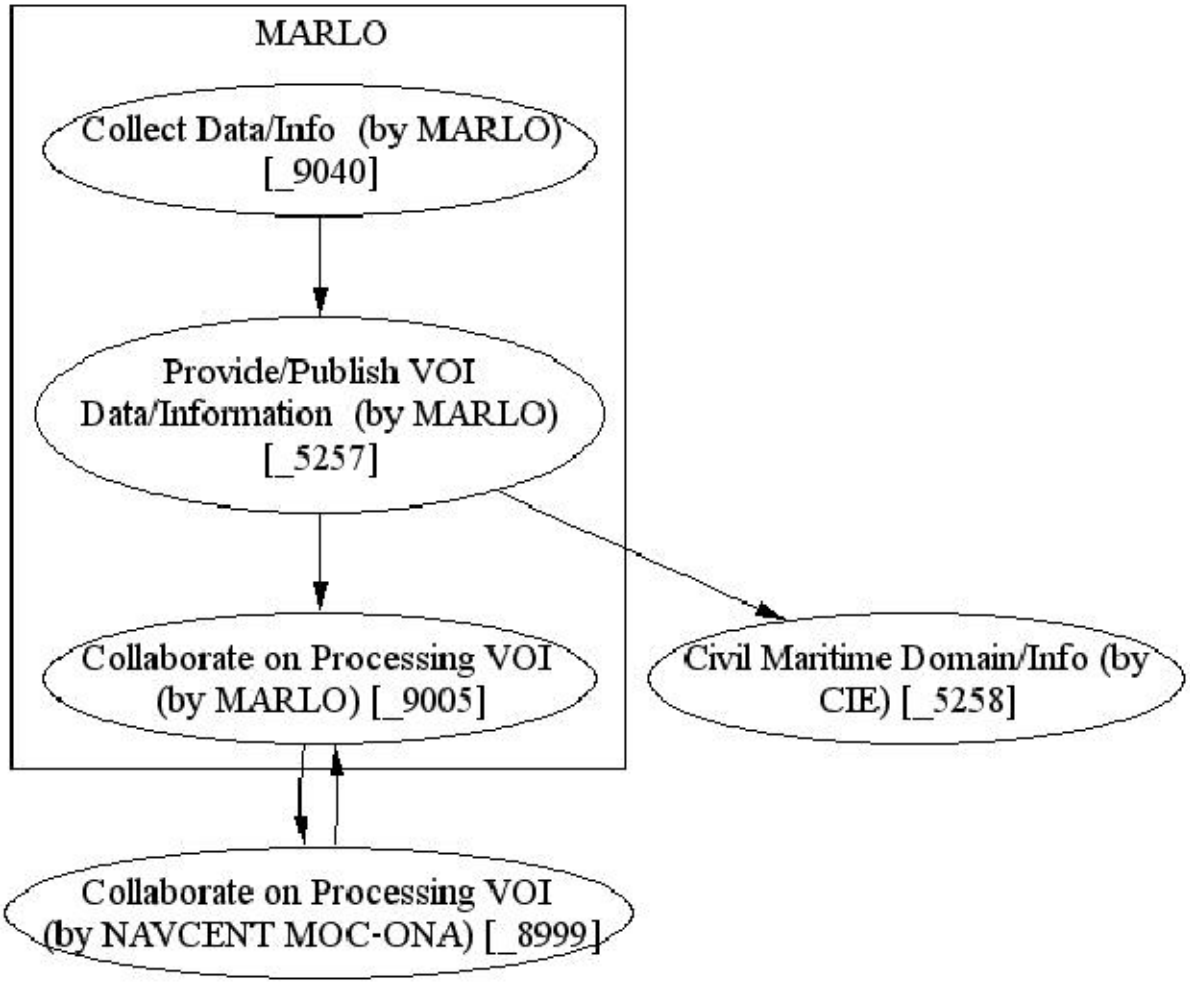


Figure 21. MDA Workflow for MIFCLANT

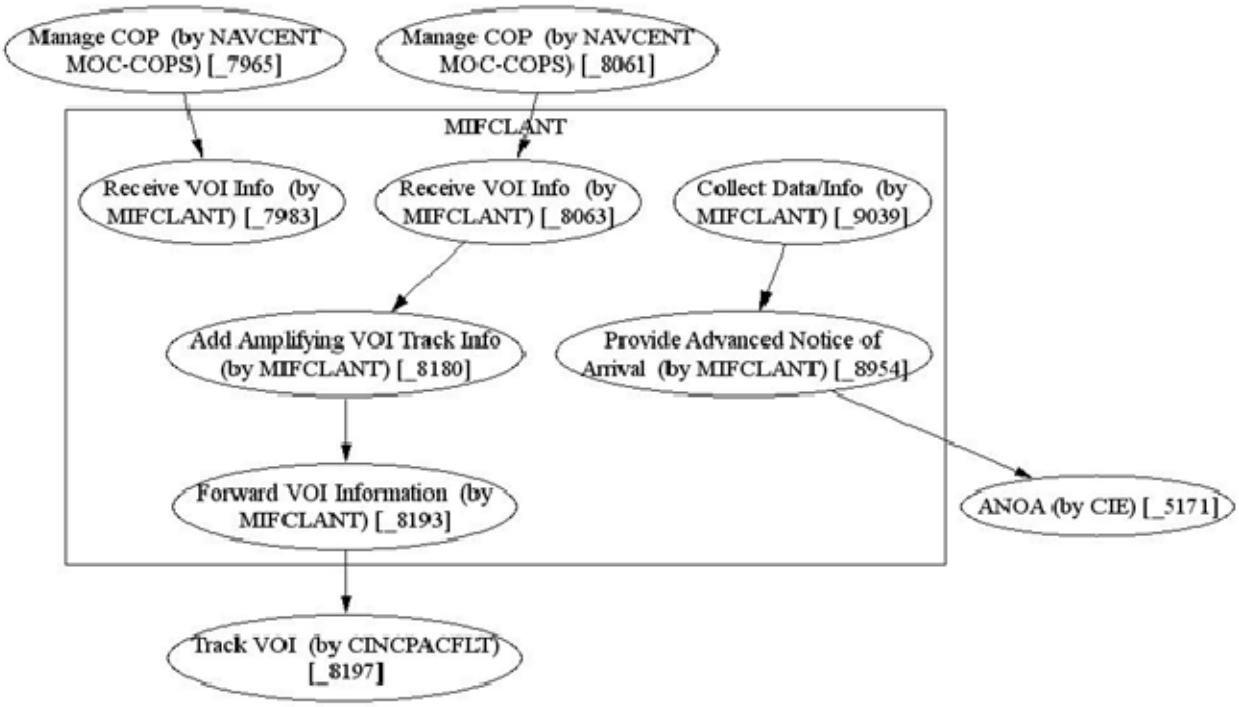


Figure 22. MDA Workflow for MIFCPAC

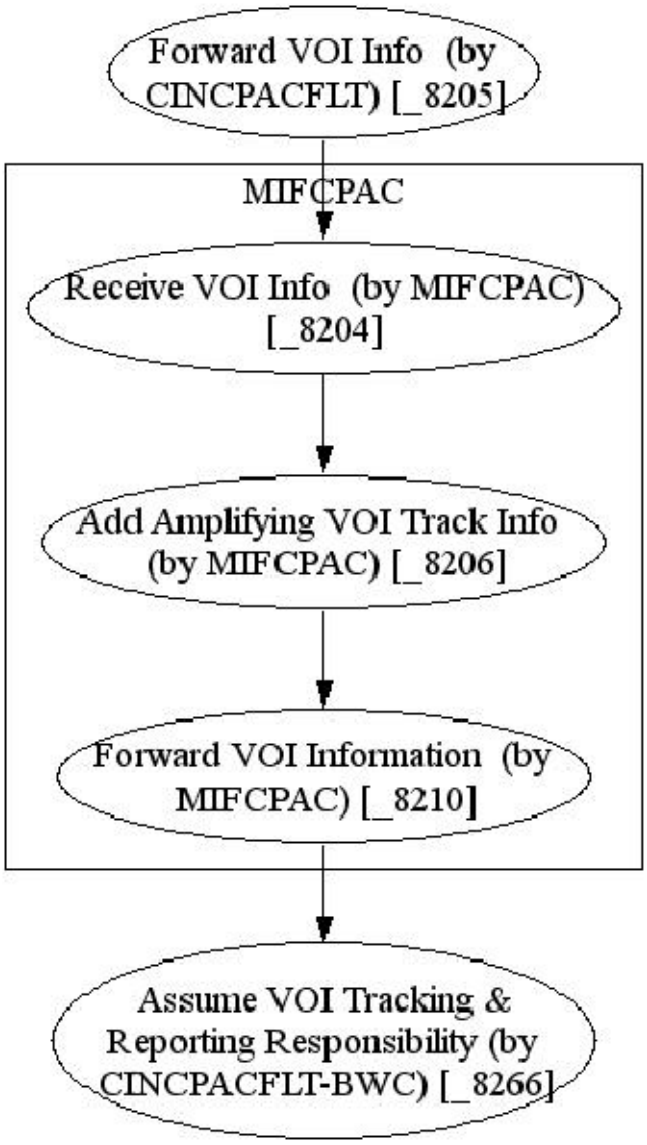


Figure 23. MDA Workflow for NAVCENT MOC Overall

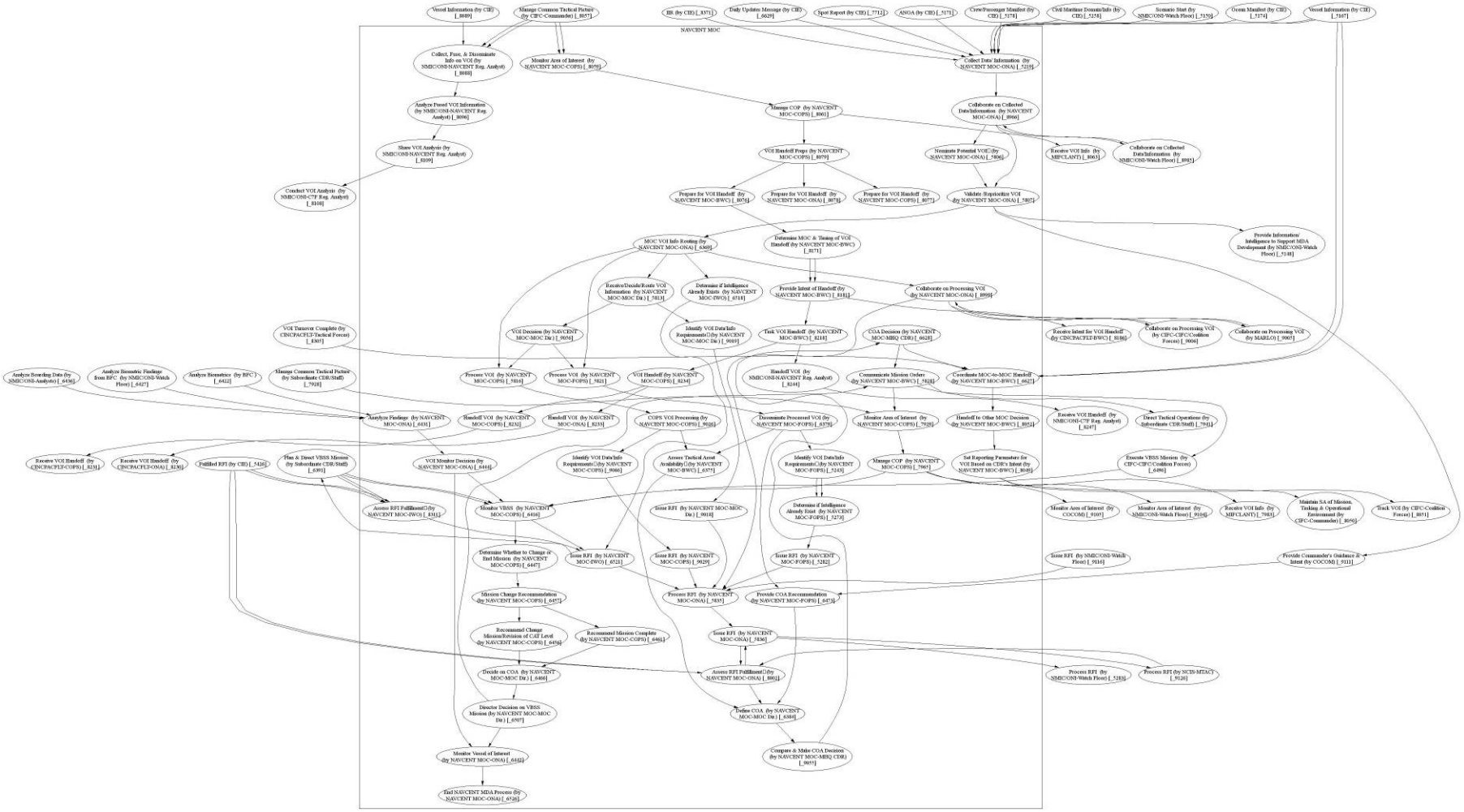


Figure 24. MDA Workflow for NAVCENT MOC: BWC

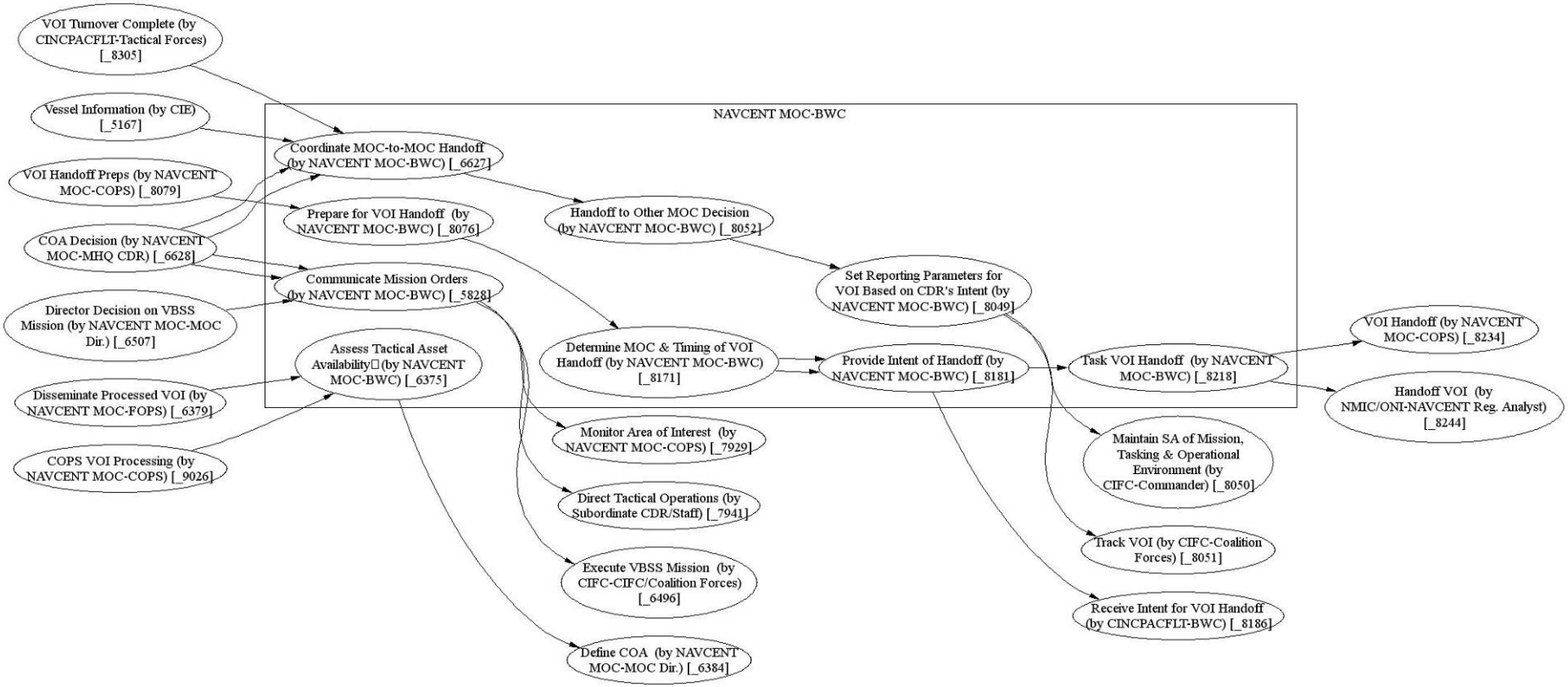


Figure 25. MDA Workflow for NAVCENT MOC: COPS

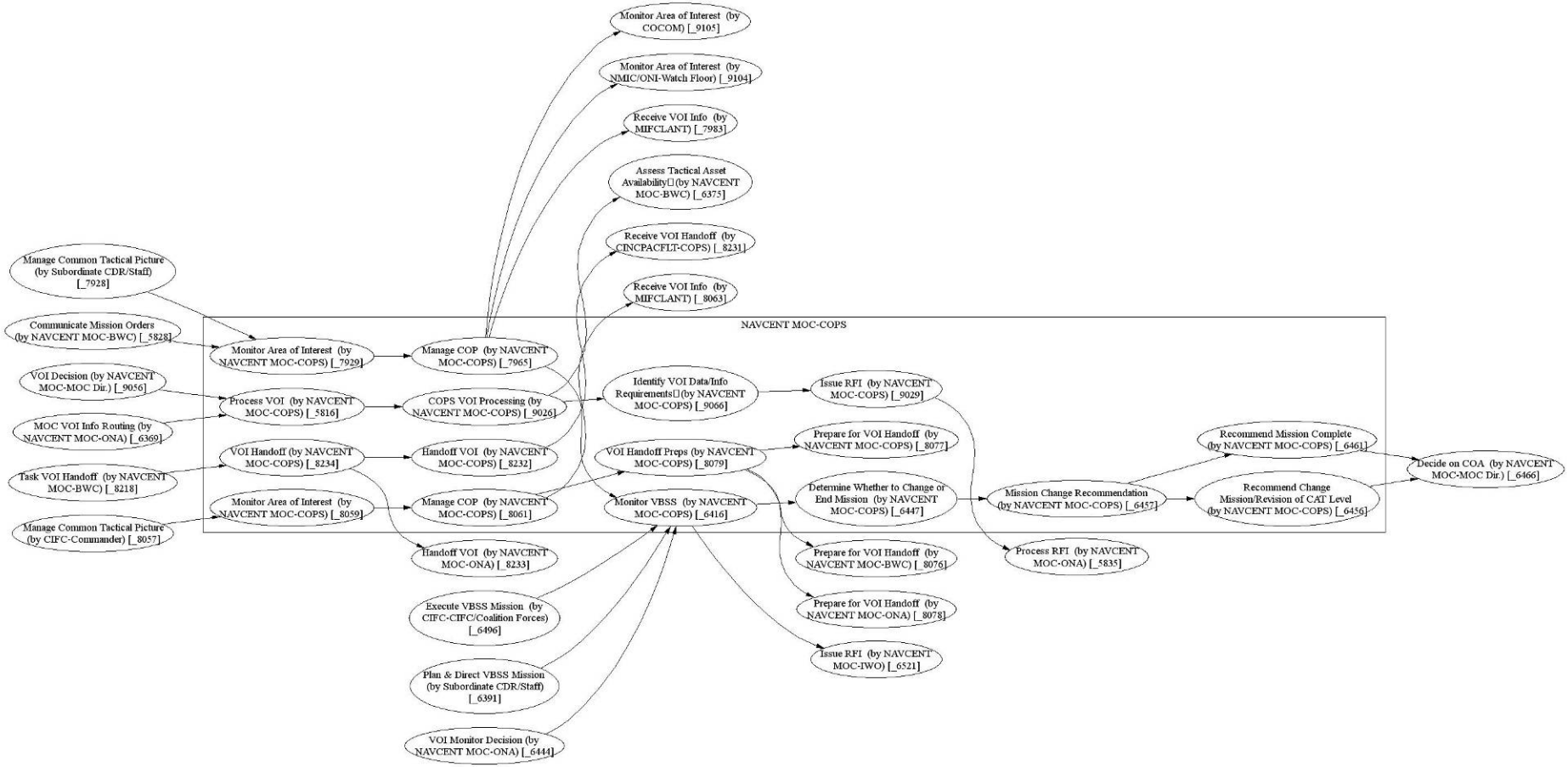


Figure 26. MDA Workflow for NAVCENT MOC: FOPS

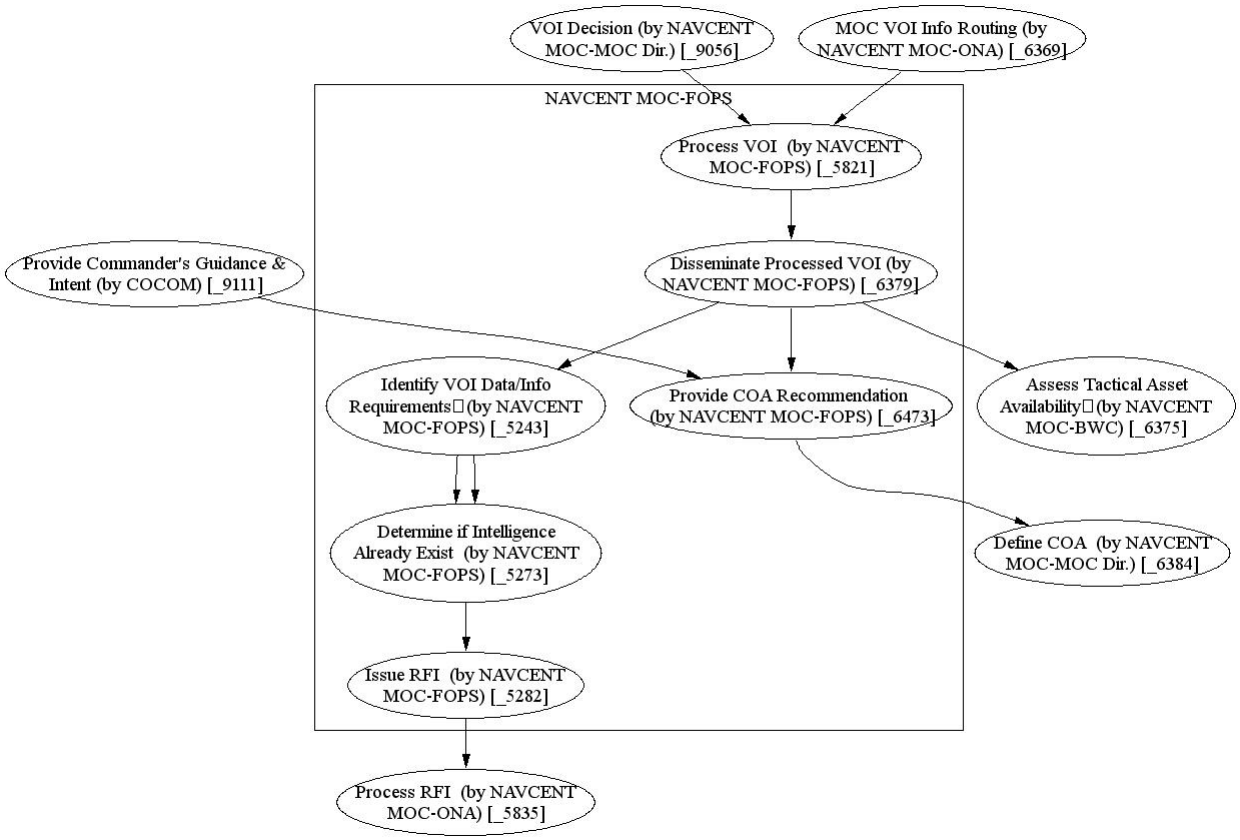


Figure 27. MDA Workflow for NAVCENT MOC: IWO

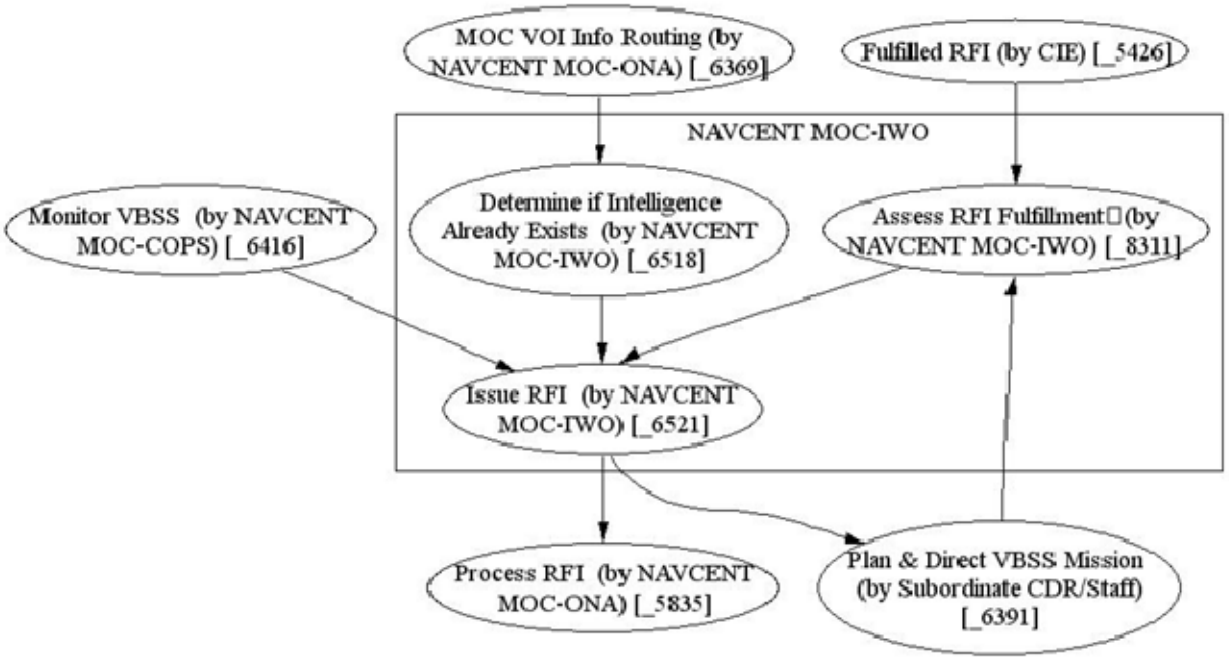


Figure 28. MDA Workflow for NAVCENT MOC: MHQ CDR

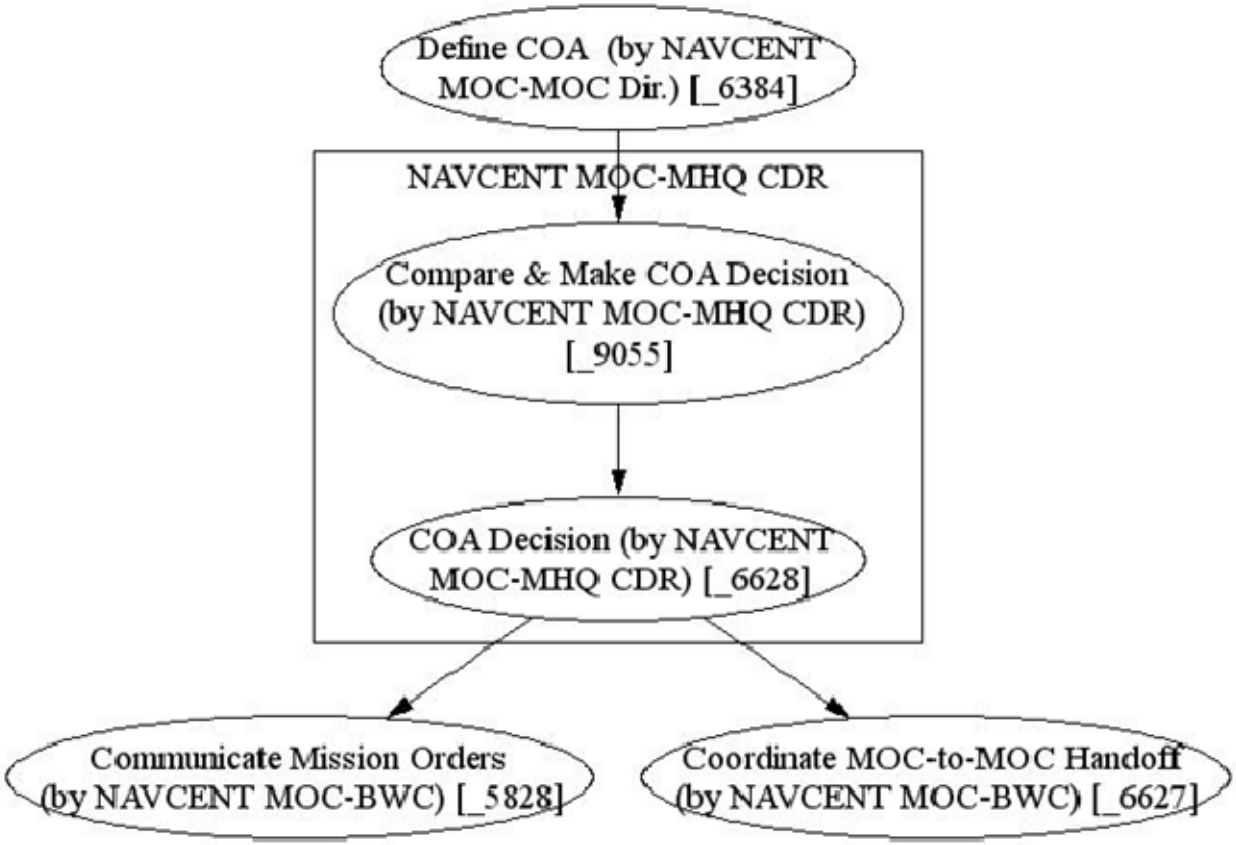


Figure 29. MDA Workflow for NAVCENT MOC: Director

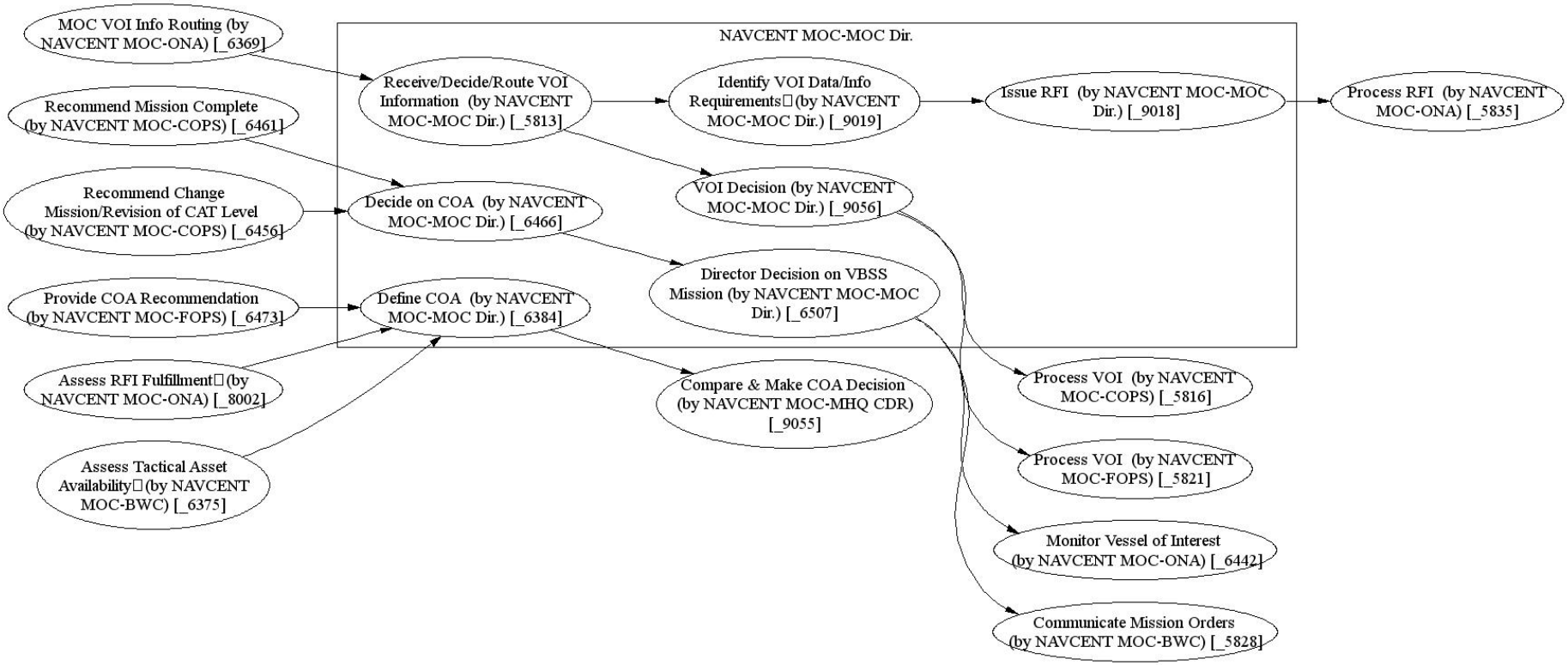
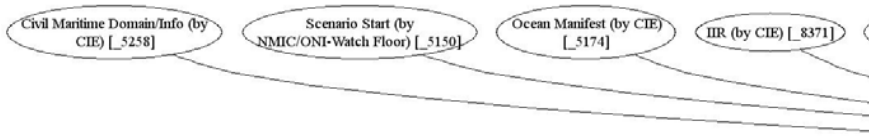
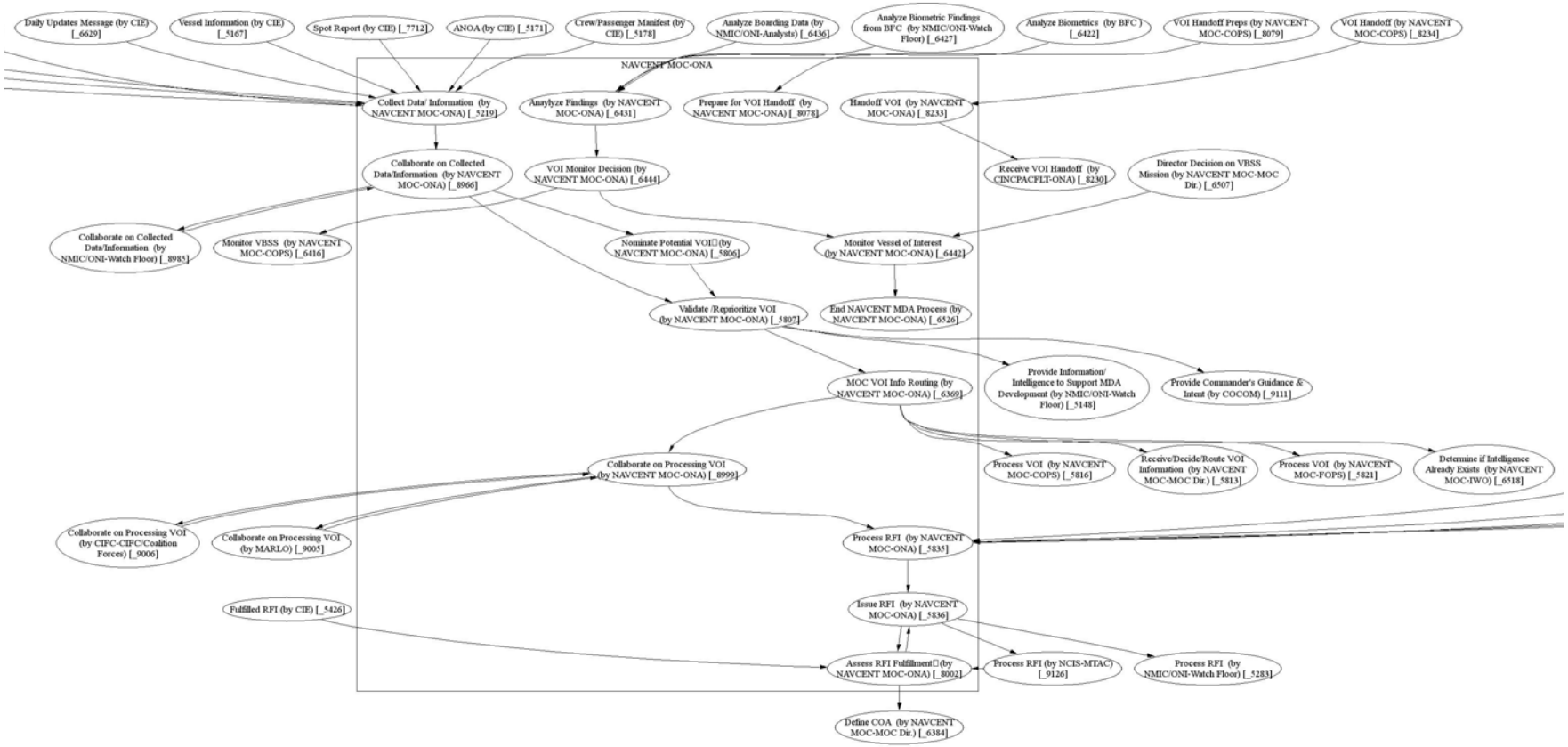


Figure 30. MDA Workflow for NAVCENT MOC: ONA

(Note: Left and right branches appear before and after the main body of the diagram)




Daily Updates Message (by CIE) [_6629]
Vessel Information (by CIE) [_5167]
Spot Report (by CIE) [_7712]
ANOA (by CIE) [_5171]
Crew/Passenger Manifest (by CIE) [_5178]
Analyze Boarding Data (by NMIC/ONI-Analysts) [_6436]
Analyze Biometric Findings from BFC (by NMIC/ONI-Watch Floor) [_6427]
Analyze Biometrics (by BFC) [_6422]
VOI Handoff Preps (by NAVCENT MOC-COPS) [_8079]
VOI Handoff (by NAVCENT MOC-COPS) [_8234]
NAVCENT MOC-ONA
Collect Data/ Information (by NAVCENT MOC-ONA) [_5219]
Anaylyze Findings (by NAVCENT MOC-ONA) [_6431]
Prepare for VOI Handoff (by NAVCENT MOC-ONA) [_8078]
Handoff VOI (by NAVCENT MOC-ONA) [_8233]
Collaborate on Collected Data/Information (by NAVCENT MOC-ONA) [_8966]
VOI Monitor Decision (by NAVCENT MOC-ONA) [_6444]
Receive VOI Handoff (by CINCPACFLT-ONA) [_8230]
Director Decision on VBSS Mission (by NAVCENT MOC-MOC Dir.) [_6507]
Collaborate on Collected Data/Information (by NMIC/ONI-Watch Floor) [_8985]
Monitor VBSS (by NAVCENT MOC-COPS) [_6416]
Nominate Potential VOI (by NAVCENT MOC-ONA) [_5806]
Monitor Vessel of Interest (by NAVCENT MOC-ONA) [_6442]
Validate /Reprioritize VOI (by NAVCENT MOC-ONA) [_5807]
End NAVCENT MDA Process (by NAVCENT MOC-ONA) [_6526]
MOC VOI Info Routing (by NAVCENT MOC-ONA) [_6369]
Provide Information/ Intelligence to Support MDA Development (by NMIC/ONI-Watch Floor) [_5148]
Provide Commander's Guidance & Intent (by COCOM) [_9111]
Collaborate on Processing VOI (by NAVCENT MOC-ONA) [_8999]
Process VOI (by NAVCENT MOC-COPS) [_5816]
Receive/Decide/Route VOI Information (by NAVCENT MOC-MOC Dir.) [_5813]
Process VOI (by NAVCENT MOC-FOPS) [_5821]
Determine if Intelligence Already Exists (by NAVCENT MOC-IWO) [_6518]
Collaborate on Processing VOI (by CIFC-CIFC/Coalition Forces) [_9006]
Collaborate on Processing VOI (by MARLO) [_9005]
Process RFI (by NAVCENT MOC-ONA) [_5835]
Fulfilled RFI (by CIE) [_5426]
Issue RFI (by NAVCENT MOC-ONA) [_5836]
Assess RFI Fulfillment (by NAVCENT MOC-ONA) [_8002]
Process RFI (by NCIS-MTAC) [_9126]
Process RFI (by NMIC/ONI-Watch Floor) [_5283]
Define COA (by NAVCENT MOC-MOC Dir.) [_6384]

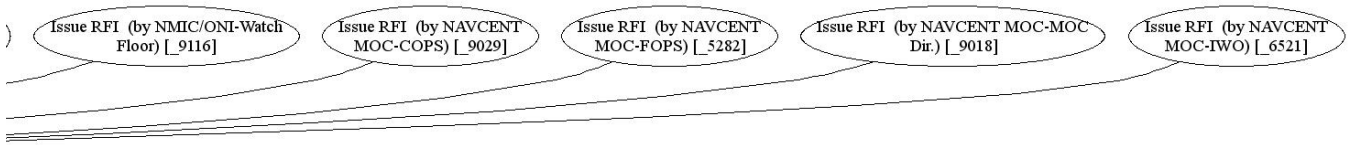

Issue RFI (by NMIC/ONI-Watch Floor) [_9116]
Issue RFI (by NAVCENT MOC-COPS) [_9029]
Issue RFI (by NAVCENT MOC-FOPS) [_5282]
Issue RFI (by NAVCENT MOC-MOC Dir.) [_9018]
Issue RFI (by NAVCENT MOC-IWO) [_6521]

Figure 31. MDA Workflow for NCIS: Field Offices

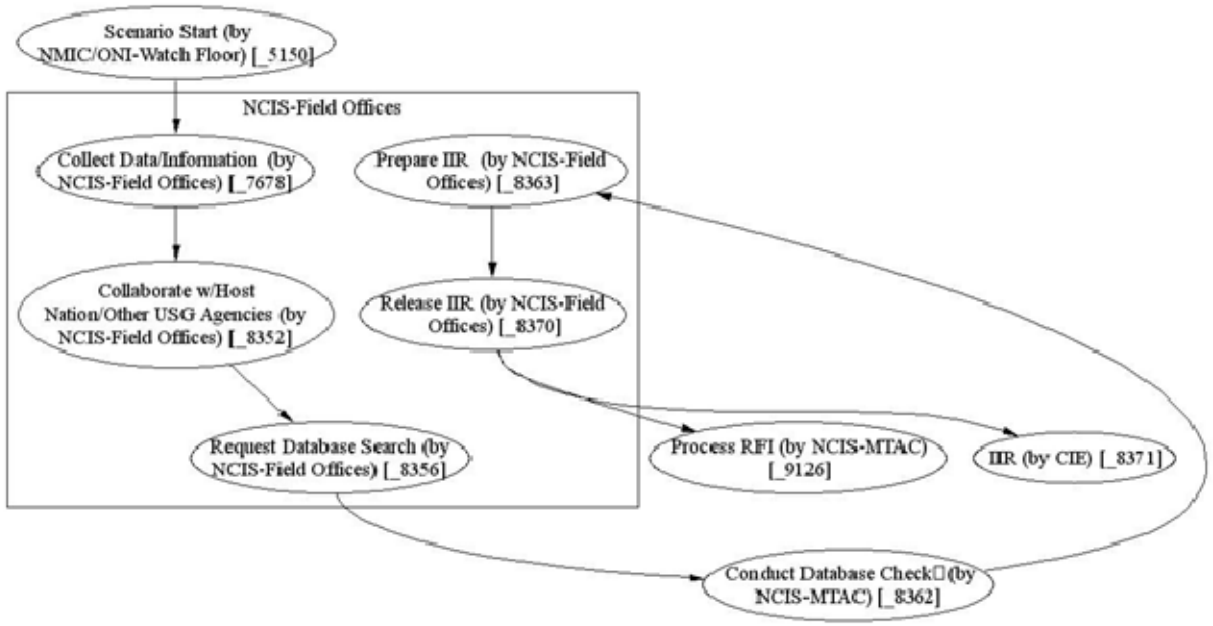


Figure 32. MDA Workflow for NCIS: MTAC

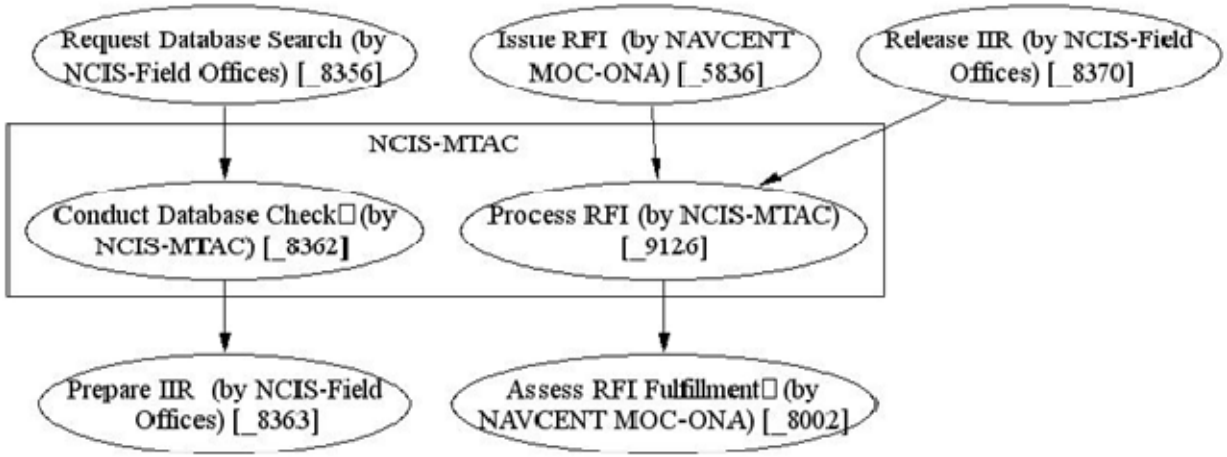


Figure 33. MDA Workflow for NMIC/ONI Overall

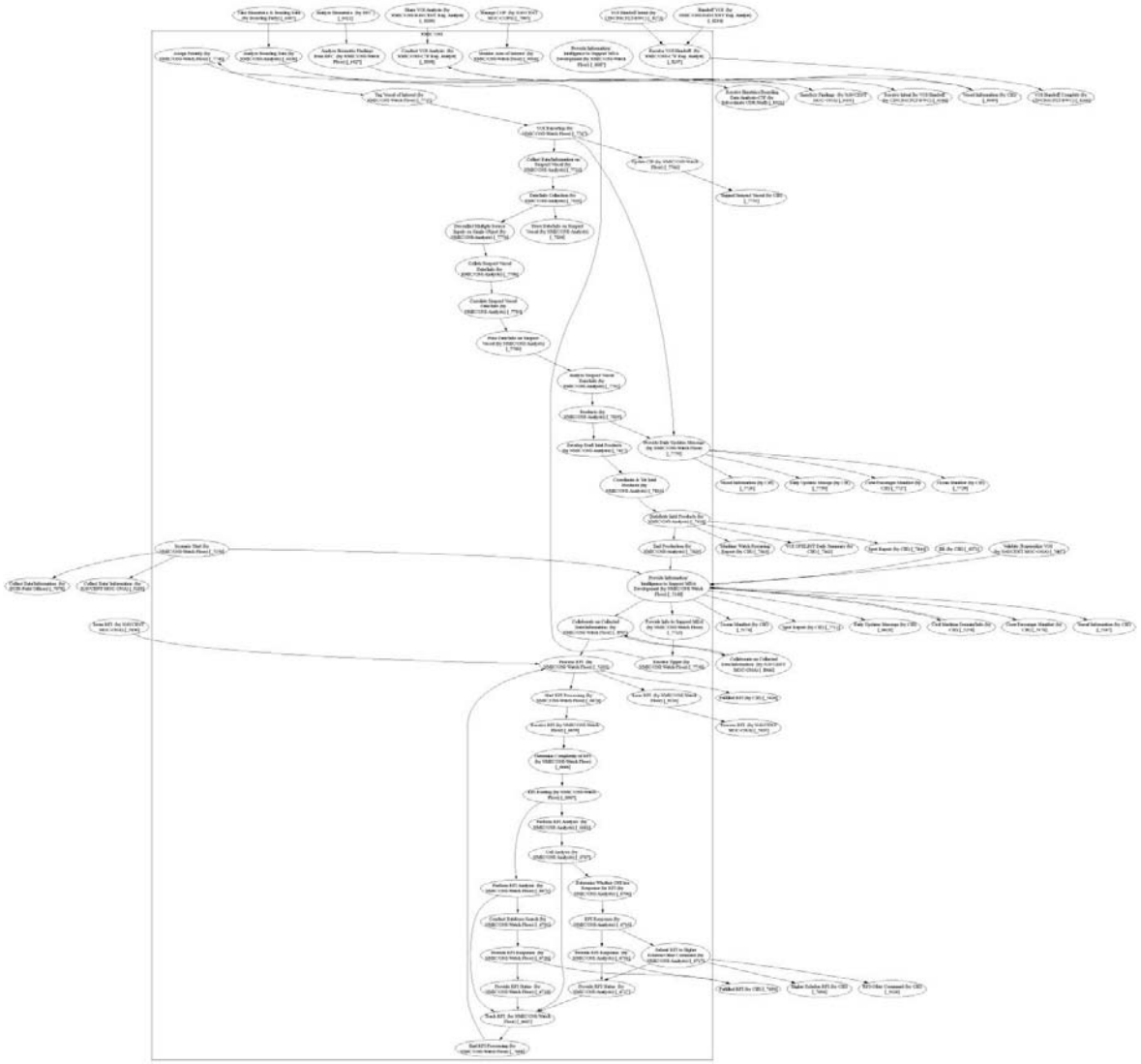


Figure 34. MDA Workflow for NMIC/ONI: Analysts

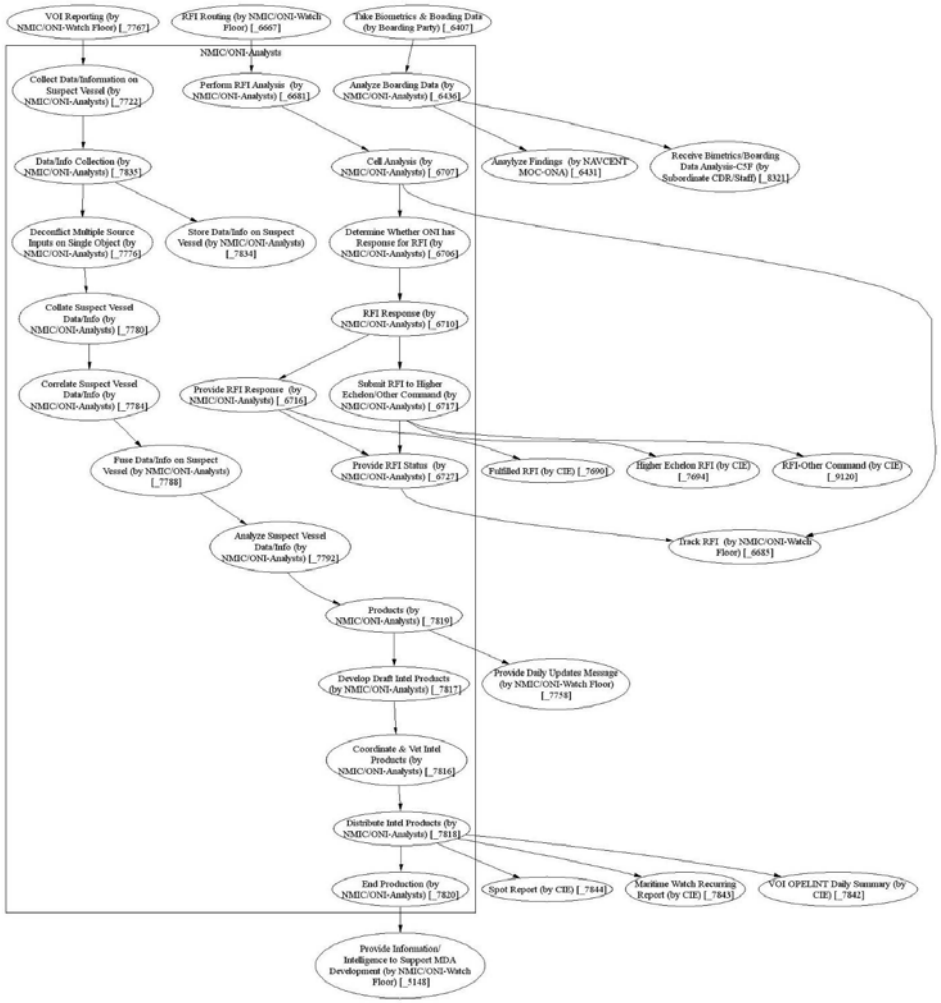


Figure 35. MDA Workflow for NMIC/ONI: C7F Regional Analyst

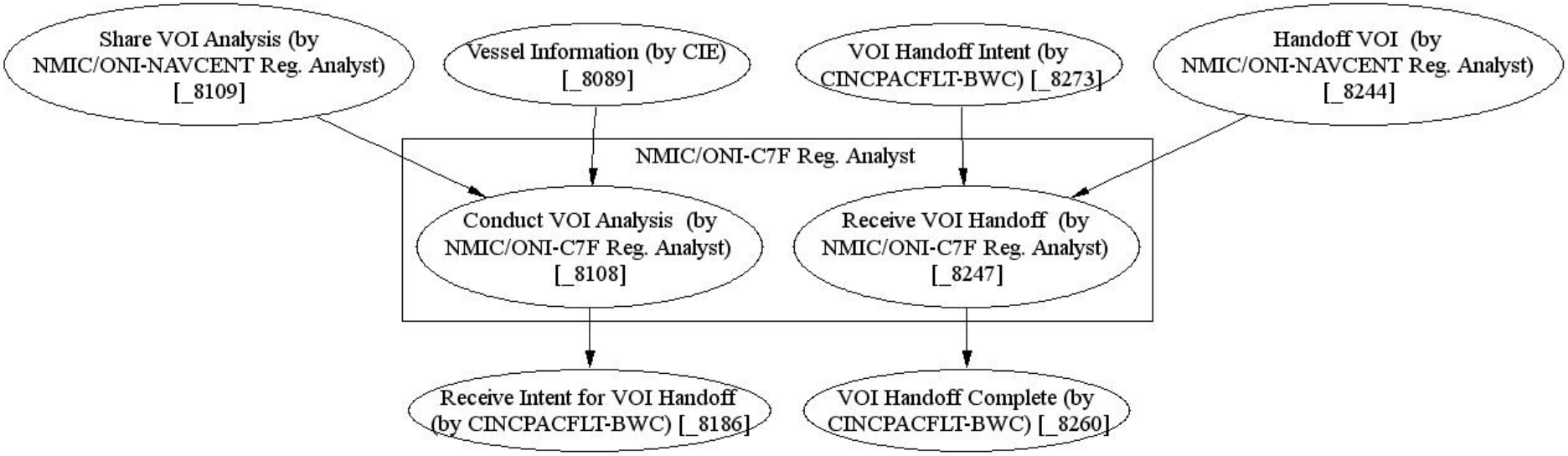


Figure 36. MDA Workflow for NMIC/ONI: Regional Analyst

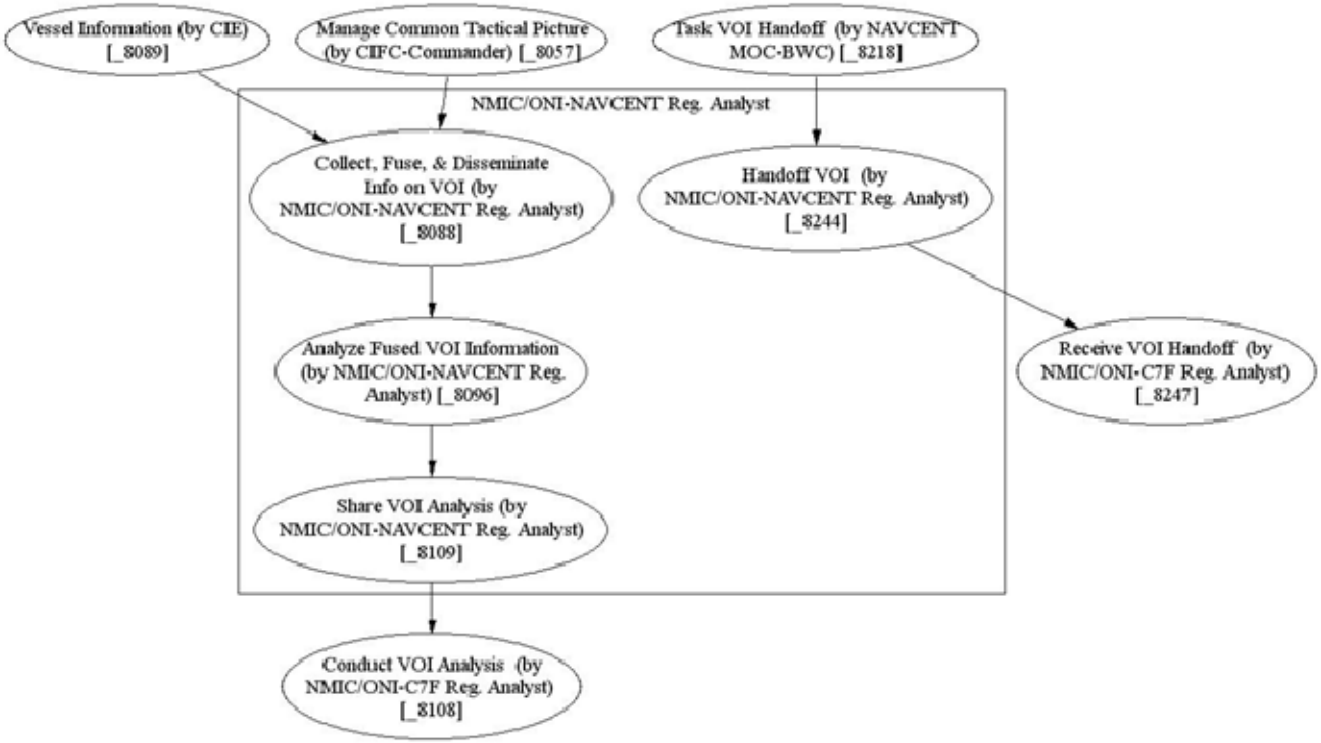
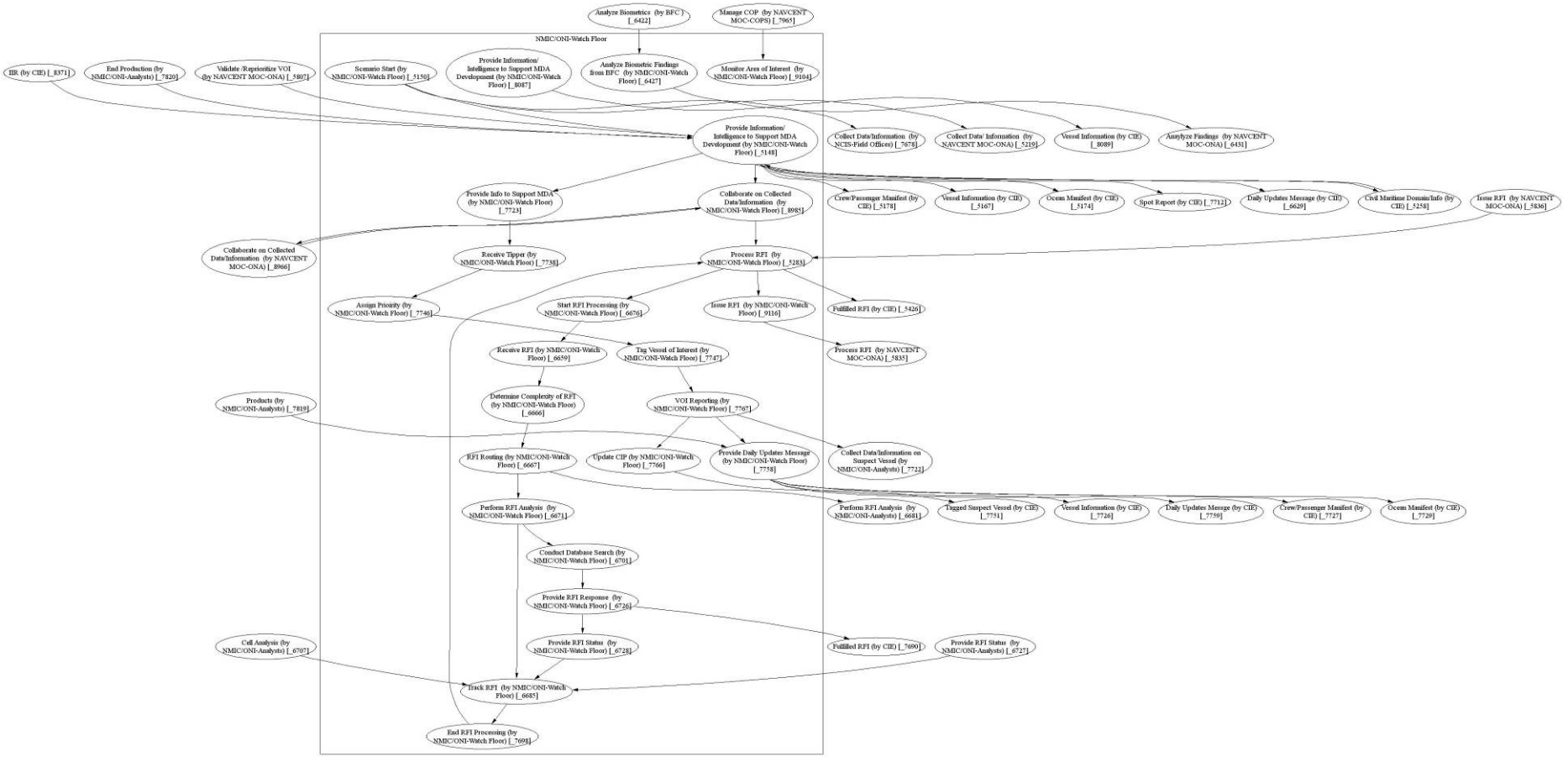
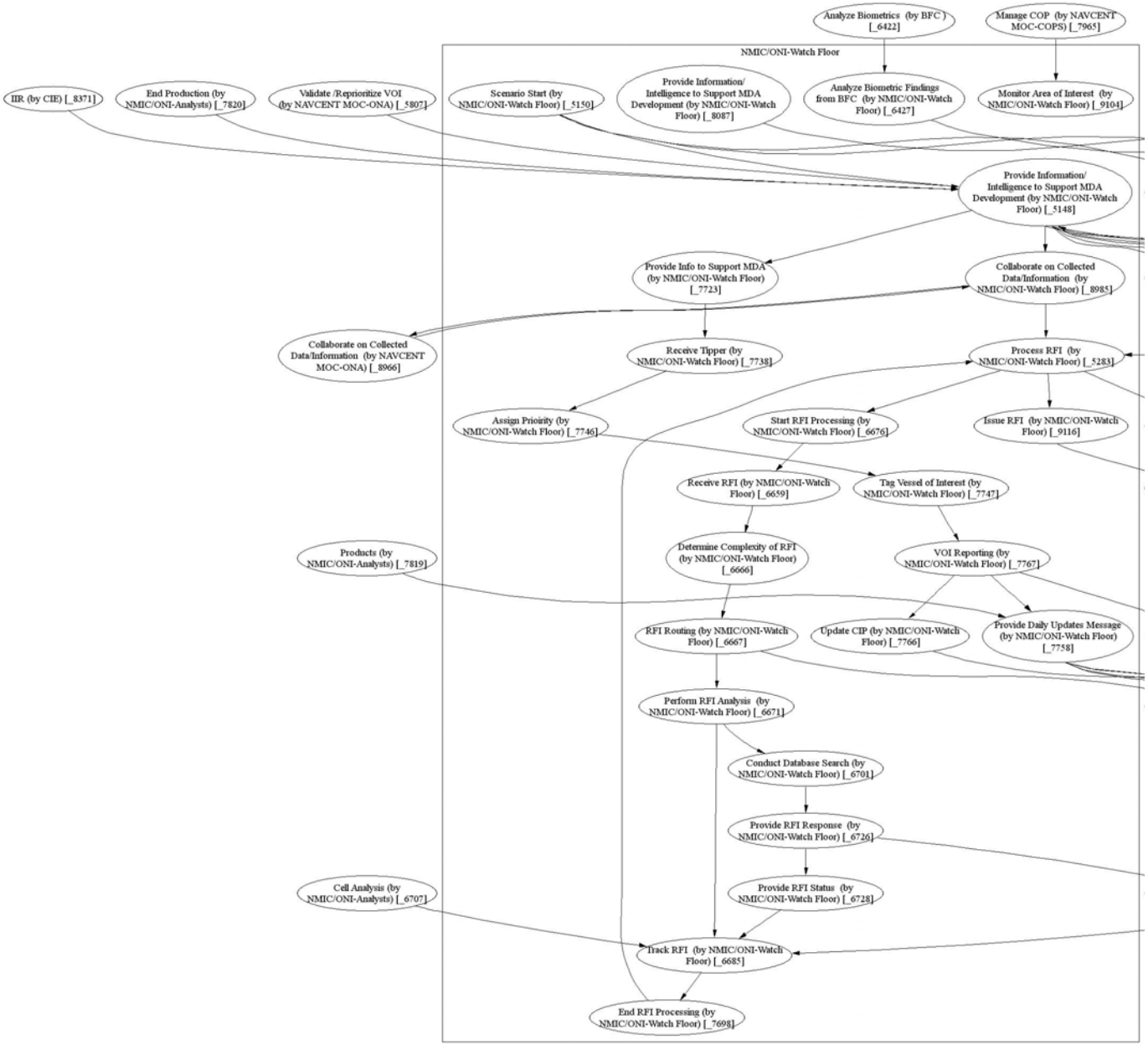


Figure 37. MDA Workflow for NMIC/ONI: Watch Floor

Note: This graph is reproduced in small but whole (this page) and large but bisected (below).




Analyze Biometrics (by BFC) [_6422]
Manage COP (by NAVCENT MOC-COPS) [_7965]
NMIC/ONI-Watch Floor
IIR (by CIE) [_8371]
End Production (by NMIC/ONI-Analysts) [_7820]
Validate /Reprioritize VOI (by NAVCENT MOC-ONA) [_5807]
Scenario Start (by NMIC/ONI-Watch Floor) [_5150]
Provide Information/ Intelligence to Support MDA Development (by NMIC/ONI-Watch Floor) [_8087]
Analyze Biometric Findings from BFC (by NMIC/ONI-Watch Floor) [_6427]
Monitor Area of Interest (by NMIC/ONI-Watch Floor) [_9104]
Provide Information/ Intelligence to Support MDA Development (by NMIC/ONI-Watch Floor) [_5148]
Provide Info to Support MDA (by NMIC/ONI-Watch Floor) [_7723]
Collaborate on Collected Data/Information (by NMIC/ONI-Watch Floor) [_8985]
Collaborate on Collected Data/Information (by NAVCENT MOC-ONA) [_8966]
Receive Tipper (by NMIC/ONI-Watch Floor) [_7738]
Process RFI (by NMIC/ONI-Watch Floor) [_5283]
Assign Priority (by NMIC/ONI-Watch Floor) [_7746]
Start RFI Processing (by NMIC/ONI-Watch Floor) [_6676]
Issue RFI (by NMIC/ONI-Watch Floor) [_9116]
Receive RFI (by NMIC/ONI-Watch Floor) [_6659]
Tag Vessel of Interest (by NMIC/ONI-Watch Floor) [_7747]
Determine Complexity of RFI (by NMIC/ONI-Watch Floor) [_6666]
Products (by NMIC/ONI-Analysts) [_7819]
VOI Reporting (by NMIC/ONI-Watch Floor) [_7767]
RFI Routing (by NMIC/ONI-Watch Floor) [_6667]
Update CIP (by NMIC/ONI-Watch Floor) [_7766]
Provide Daily Updates Message (by NMIC/ONI-Watch Floor) [_7758]
Perform RFI Analysis (by NMIC/ONI-Watch Floor) [_6671]
Conduct Database Search (by NMIC/ONI-Watch Floor) [_6701]
Provide RFI Response (by NMIC/ONI-Watch Floor) [_6726]
Cell Analysis (by NMIC/ONI-Analysts) [_6707]
Provide RFI Status (by NMIC/ONI-Watch Floor) [_6728]
Track RFI (by NMIC/ONI-Watch Floor) [_6685]
End RFI Processing (by NMIC/ONI-Watch Floor) [_7698]

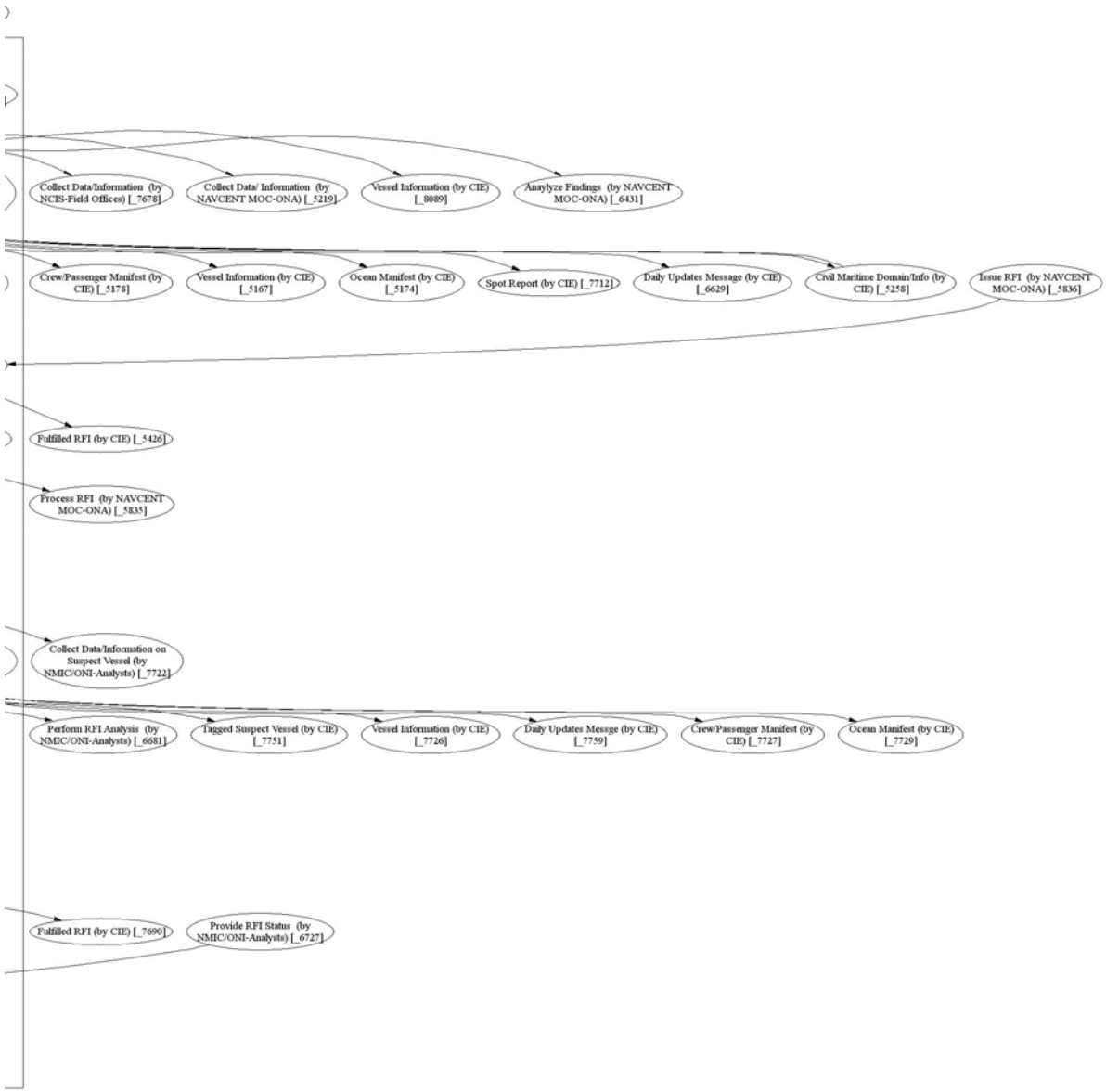

Collect Data/Information (by NCIS-Field Offices) [_7678]
Collect Data/ Information (by NAVCENT MOC-ONA) [_5219]
Vessel Information (by CIE) [_8089]
Anaylyze Findings (by NAVCENT MOC-ONA) [_6431]
Crew/Passenger Manifest (by CIE) [_5178]
Vessel Information (by CIE) [_5167]
Ocean Manifest (by CIE) [_5174]
Spot Report (by CIE) [_7712]
Daily Updates Message (by CIE) [_6629]
Civil Maritime Domain/Info (by CIE) [_5258]
Issue RFI (by NAVCENT MOC-ONA) [_5836]
Fulfilled RFI (by CIE) [_5426]
Process RFI (by NAVCENT MOC-ONA) [_5835]
Collect Data/Information on Suspect Vessel (by NMIC/ONI-Analysts) [_7722]
Perform RFI Analysis (by NMIC/ONI-Analysts) [_6681]
Tagged Suspect Vessel (by CIE) [_7751]
Vessel Information (by CIE) [_7726]
Daily Updates Messge (by CIE) [_7759]
Crew/Passenger Manifest (by CIE) [_7727]
Ocean Manifest (by CIE) [_7729]
Fulfilled RFI (by CIE) [_7690]
Provide RFI Status (by NMIC/ONI-Analysts) [_6727]

Figure 38. MDA Workflow for Subordinate Commander & Staff

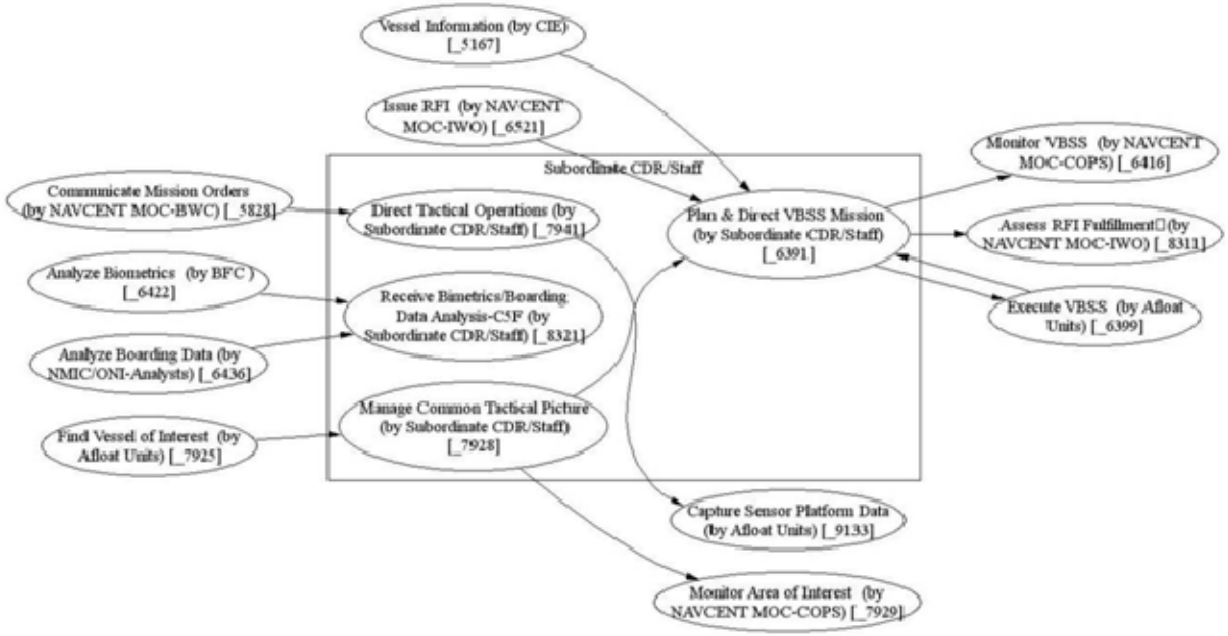
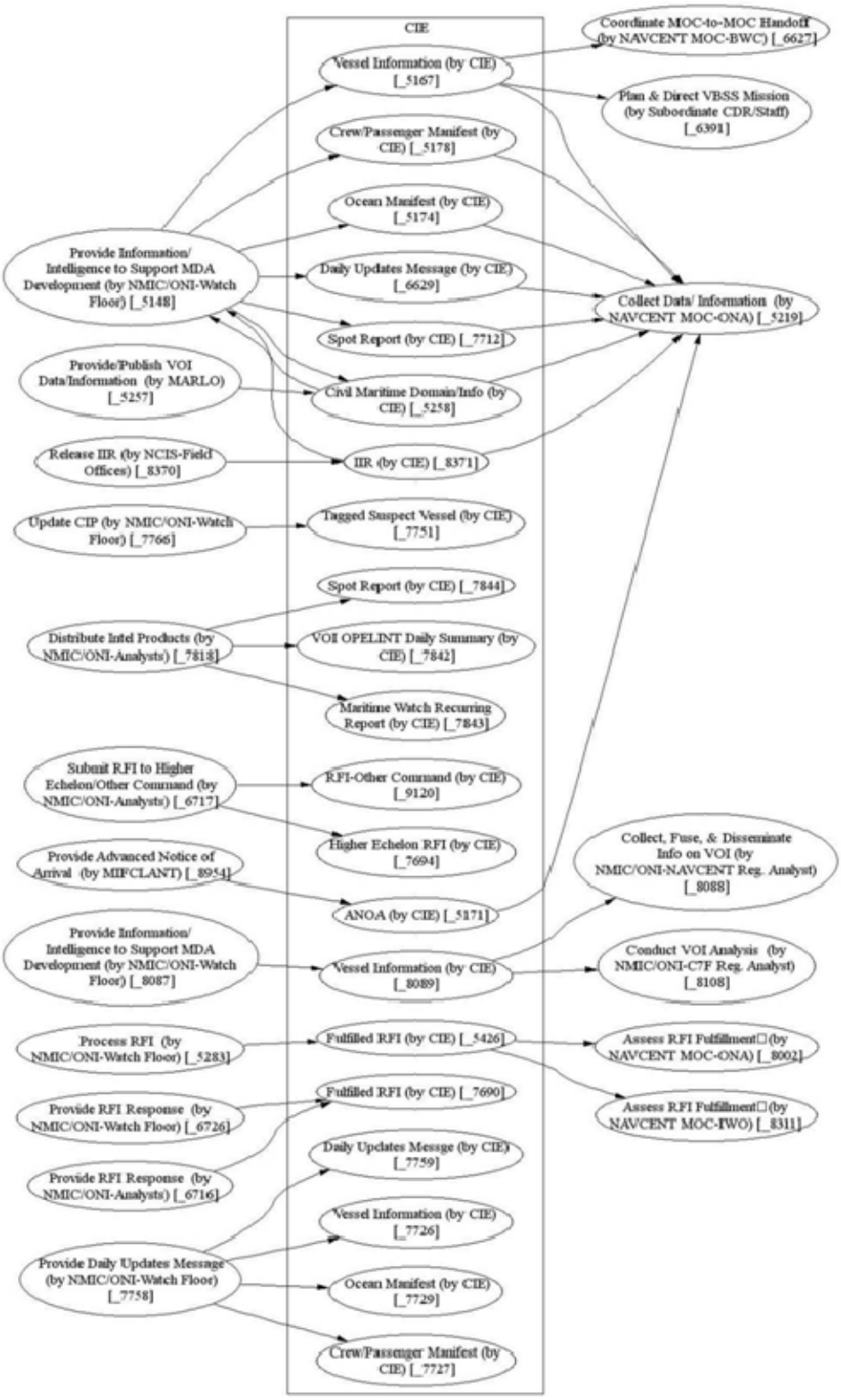


Figure 39. MDA Workflow for Collaborative Information Environment



16.0 Appendix J: MDA Capabilities

The following table presents a fine-grained mapping of Spiral-1 technologies to MDA capabilities.

Table 23. Mapping of SP1 Technologies to MDA Capabilities Thresholds.

Capability class	Capability	CMA	E-MIO Wireless	Global Trader	Google Earth	LiNX	MAGNET	Data Sharing COI	Tripwire	FASTC2AP	Potential Gaps	Potential redundancy
Monitor	**MT1**	X					X	X	X	X		**Y**
	MT2	X					X		X	X		**Y**
	MT3								X			**Y**
	MT4	X					X		X	X		**Y**
	MT5			X								**Y**
Collect	**CT1**	X		X			X	X	X	X		**Y**
	CT2									X		**Y**
	CT3										**Y**	
	CT4		X									**Y**
	CT5					X	X					**Y**
Fuse	**FT1**	X					X			X		**Y**
	FT2								X			**Y**
Analyze	**AT1**						X		X			**Y**
	AT2										**Y**	
	AT3	X						X				**Y**
	AT4						X					**Y**
	AT5										**Y**	
	AT6			X								**Y**
Dissem-inate	**DT1**				X							**Y**
	DT2										**Y**	
	DT3	X		X						X		**Y**
	DT4							X				**Y**
	DT5	X								X		**Y**
	DT6								X			**Y**
	DT7								X			**Y**
	DT8	X					X		X			**Y**
	DT9	X										**Y**

Note: This Table was developed from a presentation by PEO C4I concerning MDA test and evaluation, 21 Feb 2008 (PEO_C4I_MDA_TE Update Issues_FINAL rev2_20FEB2008.ppt)
Note: MDA Capability Thresholds are drawn from the OPNAV Scoping Document
Note: Key to capabilities

- Monitor
  - MT1: Automatically track commercial vessels worldwide: Within regional AORs; Within local sensor radius
  - MT2: Provide ability to manually enter, update, or correlate data for a specific vessel

        - MT3: Monitor select unequated vessels using ELINT data only as user-defined priorities dictate
        - MT4: Assemble and correlate lists of vessels for increased monitoring and observation from various MDA users
        - MT5: Monitor and report on available worldwide containerized cargo and bulk cargo data.
    - Collect
        - CT1: Collate available vessel data utilizing at least two or more of these sources: (a) U.S and Partner Nation AIS, (b) National Technical Means, (c) Organic Navy Sensors, (d) Intelligence Information, (e) Open Source Databases, (f) EMIO Collections , (g) Advance Notice(s) of Arrival, (h) NCIS Databases , (i) HUMINT, (j) Joint Theater Sensors, (k) U.S. and Partner Nation Coastal Collection Sites
        - CT2: Provide a central repository for establishment and maintenance of all available vessel movements and characteristics, an associated data library, and data storage capability
        - CT3: Provide a central repository for establishment and maintenance of data pertaining to available foreign-to-foreign cargo movements
        - CT4: Provide automated tools for replicating required Expanded Maritime Intercept Operations (EMIO) data for planning and execution, and provide improved data gathering, forward staging, and transmission methods of EMIO data for analysis within the afloat and enterprise data sharing environment
        - CT5: Detail NCIS personnel to selected MDA site-specific locations for the purpose of conducting focused MDA collection activities. Efforts will involve the identification, building and establishment of contacts in the port environment for the purpose of collecting MDA relevant information. Contacts will be multidisciplinary in scope with heavy emphasis on collecting data from law enforcement and security services in maritime centric locations.
    - Fuse
        - FT1: Utilize user-defined rule sets to determine a track quality that incorporates data pedigree
        - FT2: Correlate ELINT data with AIS data or some combination of data sources to identify tracks or improve track fidelity
    - Analyze
        - AT1: Automatically capture and store baseline movement behavior patterns for processing pattern recognition of specific vessels or classes of vessels
        - AT2: Report significant deviations from normal route or behavior patterns as anomalous states
        - AT3: Provide ability to collaborative via tool sets to enable cooperative maritime analysis between ONI, Theater Commanders, MHQ/MOC, and other interested partners
        - AT4: Provide ability to display of user-defined historical track data sets (i.e., long-term track histories, port(s) of debarkation, port(s) of embarkation)
        - AT5: Provided ability to create user-defined algorithms to establish baseline normal civil maritime operations worldwide and threat assessment criteria

- AT6: Provide statistical analysis of data gaps in order to identify potential new sources of information and drive new collections

- Disseminate
  - DT1: Provide a geospatial visualization capability to link all relevant, authoritative MDA data for access by all authorized users
  - DT2: Ability to establish and display automated threat assignment based on local or regional rule sets (e.g., standoff distance from an oil platform)
  - DT3: Ability to aggregate and replicate all MDA data at Maritime Headquarters / Maritime Operations Centers (MHQ/MOCs) for analysis and redistribution, in part, to their Fleet units and the Office of Naval Intelligence (ONI)
  - DT4: Allow access to designated high interest non-classified data to key partners (nations or organizations), providing a timely, utilitarian push/pull capability (e.g., Volpe, MSSIS, MDA DS COI)
  - DT5: Provide ability to establish broad collaboration and data sharing between MOCs, Other Government Agencies (OGAs), Non-government Agencies (NGAs), and partner nations
  - DT6: Ability to access and display ONI's historical maritime data / products / tools, via a web-enabled service-oriented architecture which provides automatic replication across four primary security domains for customers independent of method of access
  - DT7: Ability to contact a ONI 24/7 Help Desk to support internal and external customers of ONI's maritime data / products / tools
  - DT8: Ability to define and generate automated alerting based on user-defined areas of interest and accompanying rule sets which define when vessels trip criteria while entering, exiting, or transiting through such areas
  - DT9: Ability to log vessel analyses to national and regional archives for future analysis and decision-making

17.0 Appendix K: References

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